THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE WIRELESS SITUATION.

IT is somewhat singular that while this country was in effect the birthplace of wireless telegraphy—for it was here that Signor Marconi, aided by the Post Office Department, developed the new art from the stage of experiment to that of commercial success—the company which he founded has constantly been subjected to Governmental restrictions, interference, and obstruction, to an even greater degree than the ill-treated National Telephone Co. The root cause of the trouble was, of course, the same in both cases—the existence of a Government department engaged in commercial enterprise on similar lines, very jealous of its privileges, and more or less involved in political questions altogether alien to the business itself. In more recent years the situation has been further complicated by the entry of the Admiralty into the field, not, it is true, for commercial purposes, but as a factor more or less independent of both parties and mainly concerned with the naval applications of wireless telegraphy.

It is greatly to the credit of the Marconi Co. that, under such difficult circumstances, it has been able to hold its own, and, as evidenced by the report abstracted in our issue of August 11th, has built up a flourishing business, making a profit in a year of "unprecedented difficulty" of more than a quarter of a million sterling, paying a dividend of 15 per cent. on the ordinary shares, and carrying forward two-thirds of a million. Moreover, a reserve fund has been accumulated which exceeds the issued capital.

These figures, however, do not adequately represent the position of the company, for there are claims outstanding against Government departments, particularly the Post Office and the Admiralty, in respect of services rendered by the company and the use of its patents during the war, which involve very large amounts, and it is greatly to be regretted that almost four years after the termination of the war, these questions remain unsettled. Fortunately we gather from the speech of the chairman, Senator G. Marconi, that there is now some hope that an amicable arrangement with the Post Office will shortly be arrived at, and that this will lead to a settlement of the claims against other departments. The Senator remarked that as a result of the lack of decision on a definite line of policy this country had fallen sadly behind other countries in the erection of long-range stations; the company had been assured in 1920 that sanction would be given for this purpose, but as yet nothing had come of it, and British messages might have to be transmitted through France, Germany, or the United States until our wireless stations were ready.

But for the political fracas in 1912, a claim of Imperial high-power stations would have been erected years ago. In 1920 the Imperial Wireless Telegraphy Committee ruled out the proposal to adopt direct communication with the more distant parts of the Empire, and rejected even a range of 4,000 miles, recommending that the links of the Imperial chain should be only 2,000 miles long; but the conclusions of the Committee have now been thrown over by the Government, which, forced into a progressive policy by the pressure of the Australian Government (which with the aid of the Marconi Co. proved that direct communication was feasible), has decided to abandon the chain and to telegraph directly to India, South Africa, and Australia. As the Australian Government has entered into an agreement with Amalgamated Wireless (Australasia), Ltd., for the erection of a 1,000-kW station (by the Marconi Co.), the South African Government contemplates a similar step, and the Indian Government was about to

do the same when the British Government changed its policy, it would seem that eventually the "Imperial chain" may be replaced by a set of independent units—high-power stations erected and controlled by the Dominion Governments—the only vestiges of the original scheme being the British Government stations at home, in Egypt, and in any of the Crown Colonies where they are found necessary. The Dominions and India have unmistakably evinced their desire to entrust their long-range wireless telegraph communications to the hands of private enterprise, and we are convinced that their preference is well founded; the delays and restrictions to which the home country has been subjected in this connection by the influence of Government departments and political cliques would have been avoided if that policy had been adopted in the first instance, and indeed it would be hard to find a more glaring example of the evils of State control than is afforded by the history of wireless telegraphy in Great Britain and Ireland.

It is interesting to note that the Marconi Company, whose most profitable business has hitherto been transacted with foreign Governments, looks to the broadcasting of wireless telephony as a means to bring it into close contact with the British public by the million; we are pleased to learn that the company intends to grant licences to other manufacturers for the use of its numerous patents, and as unfair competition from abroad has been very rightly restrained by Parliamentary action, a flourishing new industry will shortly be established in this country. There is no doubt that the wonderful development of wireless telephony—one of the scientific miracles of the age—is largely due to the extended and costly researches which have been carried out by the Marconi Company from its inception, and we trust that the seed thus sown will bear an abundant harvest.

INDUSTRIAL PROBLEMS.

The word "fool-proof" is not unknown in its application to electrical apparatus. Perhaps a better word might have been chosen, but if we understand its meaning aright it is intended to convey that the device to which it is applied can be enabled to do its work satisfactorily without injury to the operator and to those in his range of operations and without detriment to the system of which it forms a part. A safeguard against failure, danger, and death. Anything that is really fool-proof is surely a good thing. Such, however, is apparently not the opinion of Mr. George Hicks, the president of the National Federation of Building Trades Operatives, who, in delivering an attack upon the Federation of British Industries, describes it as a most ruthless combination of capitalist interests "like a fabled monster of the deep in the multiplicity of its tentacles," having "its claws well into the building trades," and being out "to make the capitalist world fool-proof." "It will succeed if we are not ourselves fool-proof." If by "the capitalist world" industry be meant, then Mr. Hicks must know that nothing is more vital to the well-being of the people of these islands than fool-proof industry, for it must be safeguarded against failure, danger, and death, if the millions of workers now at work are to continue to earn their livelihood, and if employment is to be secured for the million and a-half of people who are without it. Those who have followed industrial developments in this country during the past eight years have observed that the demand for better organisation came from all quarters. It was urged as most desirable that every worker should join a union and every manufacturer an association, as by such means there could be established machinery necessary for the conduct of negotations and for dealing with the Government. The Federation movement among industries and industrial associations spread as years passed by, and the power of the unions did likewise, so that the Government of the day had the opportunity of listening to the appeals and arguments of both parties from time to time as we passed through successive awkward stages in the war and in the post-war period. Mr. Hicks recognises that the solidarity of the manufacturers is maintained at a time when he has to ask his audience at Bangor whether the workers shall remain "an example of tragic confusion, of selfish sectionalism, and of bewildering incompetence." The trade unions have been passing through a critical period as the result of the resistance they have been offering to relentlessly operating economic influences, often because of the attitude assumed by extremists who left their leaders in "tragic confusion" when they were trying to do their best for their union members. As we have often said here, the maintenance of trade unions in an effective condition is a very desirable thing, and nobody regrets more than we do the state of impotence to which the extremist minorities have reduced some of them, but it is useless for them to gird at the Federation of British Industries because of their own "tragic confusion." The report of the speech of Mr. Hicks, as received by us, makes no mention of the continued high cost of building and the reluctance of thousands of people to proceed with new work and even with necessary decoration and repair of existing property which, if they could go full steam ahead, might give employment to many of the aforesaid million and a-half. We observe that Mr. C. Tennyson, a deputy director of the F.B.I., has described Mr. Hicks's speech as "unmitigated tosh" and "hot air," and has added that the Federation exists purely for commercial purposes, the only matters of a political interest dealt with being those which have a direct reaction upon industry. If he had been attempting a reply to Mr. Hicks, Mr. Tennyson would have had a big story to tell of constructional effort continuously put forth in order to strengthen the British trade position in all parts of the world so as to bring business to British factories and British workers, and thus benefit the employés connected with the building and many other trades.

But Mr. Hicks is not the only spokesman for Labour whose recent utterances have received attention, for Mr. J. H. Thomas, M.P., has been warning the railway workers. He, too, has used the word "fools," for, in addressing a mass meeting at Chester on Sunday, he said that if the Labour Party came into power to-morrow they could not of their own accord solve the unemployment problem, and "they were only fools and knaves who said they could." Mr. Thomas has his own theory of the causes of present unemployment, but to discuss that would lead us into political matters which in these pages are anathema. There is, however, something in his speech where he is in a measure of agreement with Mr. Hicks, for he said, in dealing with the dispute with regard to the railway shopmen, that the "chaotic position in which they found themselves was due to the damnable jealousy which existed in their own ranks." Perfectly frank utterances these; the pity of it seems to be that they are most necessary, but satisfaction may perhaps be derived from the fact that they were received with "cheers," according to the Chester reports.

What would be better for the millions of industrial workers than that we should have the industrial position so stabilised by the reduction of working costs that abundant work might be obtained for us against foreign competition? All the war-time promises of the politicians and the idealists that everything would be better for everybody after the war have failed to be fulfilled. They were made in that spirit of opportunism or adaptability which seemed to hold the nation together in those times of stress, but they failed to take into account that there never had been such a war of impoverishment before, and they overlooked the probability of the common weaknesses of humanity asserting themselves when the common enemy had been defeated. Now we are "up against it," and the need is for the serious situation to be handled by men who represent all interests, including those of the great bulk of the workers, men who will not be influenced by an extreme minority. We shall win through if we will exercise our reason and show a spirit of goodwill.

Let us quote the closing sentences of a leading article on "Masters and Men" which appeared in the *Daily Telegraph* on Tuesday last:—

As water finds its own level, so will wages in all trades and occupations in this country be readjusted to world conditions; and more swiftly in this than in any other country, because we can maintain our crowded population only by selling goods or rendering services to people overseas. . . . The best friends of the workers are those who preach the subservience of both masters and men to laws and influences which are beyond their control, and urge that salvation lies in a recognition of the mutuality of their interests. A spirit of co-operation for the common end—the creation of the largest amount of wealth at the highest economic wage—is the only key with which the doors of a prosperous future can be opened.

Coming Conventions.

Similarly to last June, next month is to be a month of several conventions. The only one of purely electrical significance, however, is the meeting of the Municipal Tramways Association at Newcastle from the 13th to the 15th of the month. The subject of roller bearings for tramcars having come very much to the front recently, it is probable that at least one of the papers will deal with this matter. The apportionment of road-maintenance costs—a vexed question which arises annually—will no doubt also make its reappearance.

The meeting of the British Association at Hull from the 6th to the 13th will possess the most general interest, but present indications seem to point to a lack of electrical subjects; during recent years these have been an ever-diminishing quantity at B.A. meetings.

The Institute of Metals will include electro-metallurgical papers in the programme of its autumn meeting. This is being held at Swansea from the 20th to the 22nd.

Steelworks drives and the heat-treatment of steels are two subjects receiving attention at the York meeting of the Iron and Steel Institute (September 5th to 8th).

The international transport congress at Brussels, mentioned in our "Notes" columns to-day, will be held early in October. We have no information as to the extent of British participation in this congress, but no doubt the exchange of views which will take place will possess a great deal of interest, and will afford an opportunity for comparing electric traction with other forms of locomotion for limited areas.

An American View of British Development.

It is always interesting, and often informative, to see ourselves as others see us. Consequently an article recently published in *Commerce Reports*, commenting upon British efforts to develop the domestic load, by Mr. R. A. Lundquist, Chief of the Electrical Equipment Division, U.S. Department of Commerce, possesses many features which may be studied with profit by those concerned.

The author deals with the various methods adopted by supply authorities to popularise electricity, and first mentions the "electric home." It will be somewhat of a shock to those who have organised such exhibits to learn that the equipment of the houses is not so thorough as it might be, and compares badly with that of their American prototypes. The author does not mention any particular deficiencies, however, and admits that his information is based on "descriptions"; perhaps the Press is to blame.

Mr. Lundquist avers that a great handicap to the extended use of small domestic appliances is the bayonet-type socket. On account of its heating limitations it cannot "stand up" to the loads which a screw-type socket can carry.

We are more impressed by his third conclusion, *i.e.*, that electrical development has been retarded by the strength of the gas companies' position. He says that "vested interests have always been able to retard the development of competing industries more than has been the case in the United States." We are inclined to believe that in the States the gas companies saw the possibilities of electricity and wisely went into the business, which partly accounts for that lack of opposition which has facilitated the growth of electricity supply. But it is a fact that gas interests are strongly entrenched upon this side of the Atlantic; nevertheless, their defences are falling one by one to the electrical industry. We are forced to agree with Mr. Lundquist that cooking rates and installation costs are far too high, but until the cooking business grows prices will continue to be high—and until prices are reduced the cooking load will not grow. This is wholly dependent upon increased efficiency and lower costs, and in this respect America has the advantage of us. At the same time we are progressing, and nearly every day we hear of a reduction in the price of energy for domestic purposes. A lack of co-operation between supply authorities and electrical contractors is noted. Here, again, matters are improving, and in many districts harmonious relationships prevail. Another point is the small effort put forward by suppliers to bring the attention of the public to the advantages to be gained by the use of small appliances, and, indeed, except in-so-far as supply authorities are members of the E.D.A., this possesses a great amount of truth, speaking generally. There is still ample scope for local exhibitions, showrooms, and practical demonstrations, but many authorities cannot see beyond the cost of these, which is a state of things to be deplored. Mr. Lundquist does not favour the "hire" scheme for cooking appliances, as he thinks it unduly increases the investment of the supply authority. In present circumstances we do not think that there is an alternative; the majority of consumers certainly cannot afford to purchase electric cookers outright, and in any case the gas industry has done well out of the method. Still, in spite of the vulnerability of the industry to criticism, the author is forced to the conclusion that prospects are good, and he thinks that "a growing market for American devices should result," a conclusion that we are insular enough to hope will not be fulfilled before the resources of British manufacturers are exhausted.

The Gennevilliers Visit.—Important Notice.

The date of the visit to the Gennevilliers Power Station is now definitely fixed as Saturday, October 7th, at 2.15 p.m. Members of the party will therefore leave London for Paris on Friday, October 6th. Sunday will be left free for visits to Versailles or Malmaison, or other places of interest in the vicinity of Paris. Members can then return to London on Monday or, which we strongly recommend, spend a further two days visiting the reconstruction work in the devastated areas of the North. Arrangements for this extended visit are well advanced, and we shall shortly circularise all those who have signified their intention of joining the party, giving full particulars as to routes and expense.

Further applications to join the party can only be entertained in the event of members who have already intimated their intention of going finding it impossible to do so, and thereby creating vacancies.

New German Combinations.

A new concentration movement in connection with coal and steel interests on the one hand and electrical undertakings on the other is now in progress in Germany. The former are represented by the Phœnix Mining and Ironworks Co., of Hoerde, and the latter by the Saxony Electrical Works, of Dresden, and the Schorch Electrical Works, of Rheydt. It has already been decided to increase the share capital of the Saxony works from 78,600,000 to 143,000,000 marks. Of this an amount of 26,600,000 marks will be taken over by the Phœnix Company, while the Schorch works are to be brought into close financial connection with the Saxony works. It is reported that other undertakings are also to be included in this new group. Further information has been received to the effect that two associations of merchant electrical firms in Germany have decided to amalgamate under the title of the Association of Electrical Wholesalers and Exporters, with offices in Berlin.

D

MANSFIELD ELECTRICITY SUPPLY UNDERTAKING.

Mansfield is a twentieth-century development. In 1901, when the electricity undertaking was mooted, the population was 21,000. Now, within four miles of the Town Hall, there are over 105,000 souls. They are still coming, and likely to come—the district being one of the richest in coal in the country, while cotton doubling, boot making, hosiery, ironfounding, quarrying, and tin-box making flourish exceedingly.

Until recently the growth of the Mansfield electricity undertaking has borne little relation to that of the rapidly-increasing district it is supposed to cater for. Even now the capacity is small for such a population.

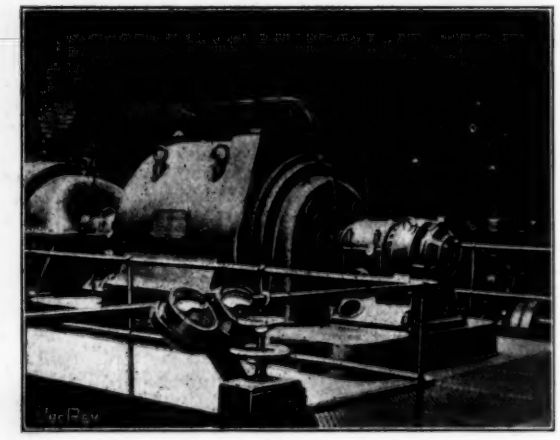

Fig. 1.—Willans-G.E.C. 1,500-kW Turbo-generator.

Due to conservative policy, fear of killing the gas department too soon, and perhaps other influences of a more subtle character not known elsewhere, until quite recently, the generating plant had not been extended since 1911, though the increase in demand had been considerable. In 1913 the limit of reserve was reached, and passed; and 1914 found the load on the works greatly in excess of the normal plant capacity, with reserve. This position was accentuated in 1915 when the supply of electricity to the large Military Camp at Clipstone was undertaken. To enable this to be done, two 250-kW rotary converters, running inverted, were installed. The undertaking, due, shall we say, to good fortune, in spite of overloading and the impossibility of proper overhaul and repairs, experienced no breakdowns, such stoppages as did occur being due to air raids.

In 1917 a serious, but unsuccessful, attempt was made to obtain sanction to extensions from the Ministry of Munitions. At that time, it will be remembered, the coal conservators were in power, and the immediate scrapping of all stations of a capacity less than 100,000 kilowatts was the ruling idea, so Mansfield had to wait until 1919, when permission to extend was given by a less idealistic body.

Orders were placed, and contracts entered into, but the times were bad; the builders were at the height of their housing triumph, labour was very difficult, very dear, very slow, and very careless. In consequence two years elapsed before the supply from the new plant was available. It was finally started up in December, 1921, and has been running satisfactorily since then.

The station as now equipped contains three 200-kW Parker-Alley and one 400-kW Belliss-B.T.H. d.c. sets, all equipped with Ledward ejector condensers, and one 1,500-kW Willans-G.E.C. turbo-alternator and surface condenser with Rees Roturbo pumps. There is space in the new building extension for a further 1,500- or 2,000-kW set. There are two 250- and one 500-kW B.T.H. rotary converters; the former are arranged for both direct and inverted running, and are fitted with exciters and induction regulators.

The switchboards, of a total length of nearly 100 feet, comprise five h.p. stoneware cubicles with separate control panels; a rotary converter board with duplicate busbars, and throw-overs for either lighting or traction on the d.c. side, all supplied by the B.T.H. Company; five d.c. generator and battery panels, and 16 feeder panels by Messrs. Bertram Thomas.

There are two storage batteries. One is of the Tudor type, with 292 cells, 1,000-ampere-hour capacity, used generally with the public supply; the other is a D.P. battery of 267 cells, 720 ampere-hour capacity, used in conjunction with a Crompton auto-booster for traction. The latter machine is a development of the original booster made to Mr. Hewlett's specification for Mount Morgan in 1897. The batteries can be used on either supply. The boiler house contains at present three Lancashire 30 ft. by 8 ft., and two Babcock 12,000-lb. boilers, with space for a further extension of 30,000 lb. Water for condensing is obtained from the little River Maun (from which the town gets its name) by two separate pipe lines of 15 in. and 20 in. diameter respectively; the flow is generally sufficient for the needs of the works, but cooling towers are contemplated for the future.

The present stage of development is a transitory one, and the running arrangements are necessarily complicated. The reciprocating plant and batteries are available as reserve up to 1,200 kilowatts, and 500 kilowatts are available either way. The rotaries can be run on either general or traction supply. The water-tube boilers are arranged to supply saturated or superheated steam as required.

The general routine of operation for economical running is as follows: The turbo set takes the load from early morning until after the peak, when one or more reciprocators are run up and changed over. At or before midnight the batteries are used, with one rotary running inverted for the high-pressure supply. The Belliss engine is coupled to two dynamos in tandem, and a good deal of the lighter work is done with this; one dynamo on general supply and the other on

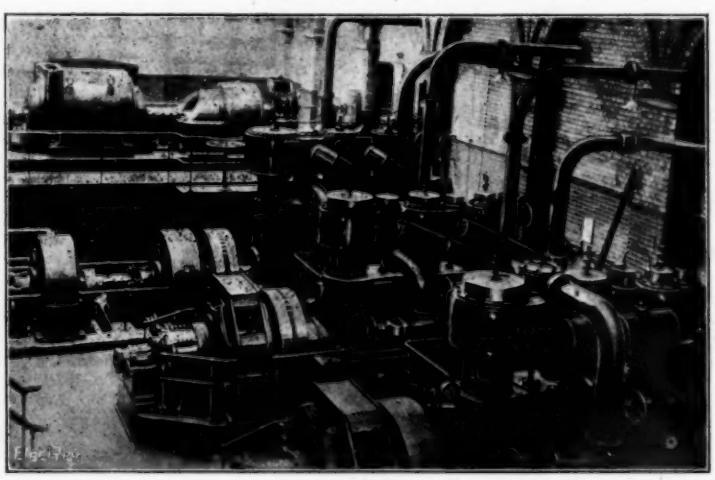

Fig. 2.—Reciprocating Sets and Turbo-generator.

traction. There is a good deal of changing over, which the excellent design of the switchgear makes simple and safe.

The station is further complicated by a "dust factory" or refuse destructor, from which steam is obtained in the way common to such combinations.

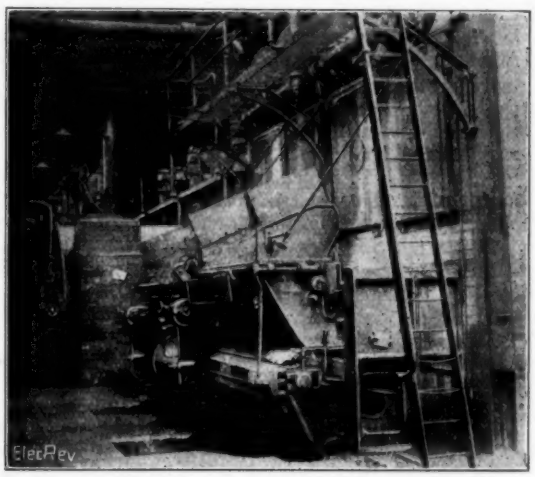

Fig. 3.—The Boiler-House.

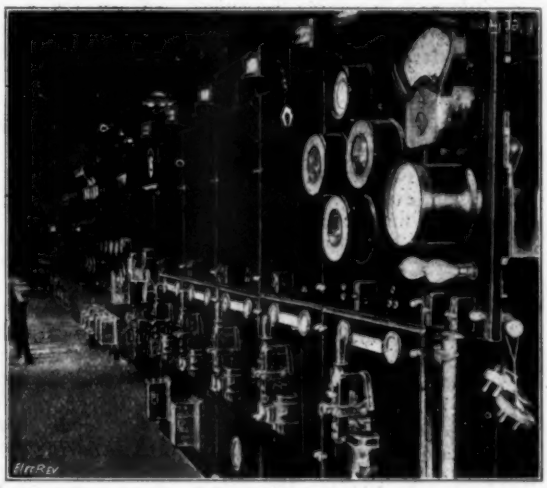

Fig. 4.—High-pressure Switchgear.

Outside the station the past year has seen considerable development. Two new d.c. and one high-pressure a.c. feeders have been laid, at a cost of £12,000, and a similar sum has been spent on supplies to two housing schemes. There are at present over 50 miles of mains, and 100 public lamps are connected.

Mr. E. Holcombe Hewlett, M.I.E.E., M.Am.I.E.E., is the borough electrical engineer, and since 1906 he has been solely responsible for all work that has been carried out; we are indebted to him for the foregoing particulars and for the photographs reproduced herewith.

ELECTRICAL PROGRESS IN SOUTH AMERICA.

Brazilian Developments Active. Chilean Wireless Extensions. British Contracts Placed.

(By Our Special Correspondent.)

The numerous reports which have been made, at the request of the Brazilian Government, upon the possibilities of utilising the Iguasú Falls for electric lighting and power, have at length resulted in some definite practical steps being taken. The Brazilian diplomatic representative in Buenos Aires has officially informed the Argentine Minister of Foreign Affairs that his Government has accepted the general conditions of the projected treaty proposed by the Argentine Ministry of Foreign Affairs for harnessing the Iguazú Falls and transmitting electricity to the capital of Argentina and other important cities *en route*. This long-outstanding matter having been satisfactorily arranged from a diplomatic point of view, the commercial prospect assumes a more promising aspect. We understand that an American and British syndicate has promised the greater part of the capital necessary for the comprehensive exploitation of these remarkable falls, the commercial possibilities of which have already been commented upon in these columns.

An important alteration in the proprietorship of the Companhia Telefónica Rio Grandense, in Brazil, has recently taken place. The former owner of the power station at Bagé has effected a sale of his power to the firm of Superville, Barbará, Buxton, Guilaym y Cia., which, for the purpose of acquisition, has formed a capital of 1,300,000 milreis, the whole of which has been paid up. It is intended to introduce a number of much-needed improvements in the service of illumination and distribution of power, and, to effect this, an entirely new equipment has been ordered. It is satisfactory to know that the contract has been awarded to a British firm at Liverpool, which is now busily engaged in carrying out the manufacture of the various machinery and equipment which will form the new plant. Much progress has already been made, and it is hoped that the first shipment will take place this month (August). British engineers will be dispatched to Brazil for the purpose of erecting the machinery and seeing it at work before the plant is finally handed over to the new proprietors.

Of all the Brazilian States forming the Union, 20 in number. Sao Paulo has been the most progressive with regard to hydroelectric development. In this part of the country coal is not to be obtained except by importation, the State, geologically, being bare of the mineral. Adjoining provinces are equally unfortunate; the nearest approach to a coal deposit is a form of lignite, which is 25 per cent. ash, and, therefore, of very little value as a fuel. On the other hand, there is an abundant supply of latent water-power, only a small part of which has been developed by hydro-electric installations; but it may be said with truth that no other State in South America is so highly advanced in this respect. Ali important towns and cities of the State of Sao Paulo have their individual electrical plants, industrial development being greatly assisted by the cheap and continuous power provided. In this part of the Republic are found the headwaters of various rivers forming the main feeders of the vast River Plate basin of Paraguay and Argentina. On the borders of the State no fewer than eight good-sized rivers run their courses; while the country, being of a very mountainous character, provides a number of falls and rapids which could be made to furnish never-failing water-power supplies. A careful computation has been made of the power available in this State; this has been placed at 2,800,000 h.p. in water falls, of which, rather less than one-tenth has been as yet adapted to electrical use.

The Chilean Government has placed a number of orders with European firms, as well as with others in the United States, for the erection of new wireless stations. Among the latest opened by the Navy Department has been a station at Puerto Bories, Ultima Esperanza,

located in the southernmost part of the Republic. Other wireless stations have been established in the Magellan Territory, Tierra del Fuego and in the Patagonian channel region. Work upon these installations has been practically completed, and either the President or one of his Ministers will be invited to open them officially with becoming ceremony. When the whole chain of stations is finished and ready to operate, the Chilean wireless system will unite even the most remote southern parts of the Republic, such as Punta Arenas, with the rest of the country.

A number of graduates of the Santiago Vocational School have recently been dispatched by the Chilean Government to the United States under contract with the Westinghouse Electric Co. to carry out advanced work in the shops of that firm, and, later on, return to Chile as electricians in connection with the Westinghouse contract for the electrification of the railway now being constructed between the port of Valparaiso and the capital, Santiago.

In Columbia, wireless telegraphy is making satisfactory progress. At the request of the Columbian Government at Bogotá, the British Marconi Co. has dispatched a representative, accompanied by a number of technical experts, charged with the task of opening wireless stations at Cucutá, Medellín, Barranquilla, and the central station at Bogotá. The last-named receiving station is located at Cerrito and the sending station at Chapinera, the two being united by a cable which extends to the central telegraph office. For some considerable time past three young Colombian electrical engineers chosen by the Minister of Hacienda (Promotion) for their conspicuous ability and technical enthusiasm, have been studying wireless telegraphy in London. These promising young engineers are now on their way back to Colombia, and upon their arrival there they will take charge of the station about to be opened.

In Cuba, an organisation known as the Radio Corporation has been formed for the purpose of the importation and sale of radio apparatus. It is hoped that suitable arrangements may be made with British manufacturers of this class of plant, which enjoys a high reputation throughout the Caribbean, and, indeed, throughout South America. The 100-ft. wireless towers of the transmission station of the Cuban Telephone Co. have now been completed, thus enabling Habaña, the capital and chief port of the island, to receive broadcasting from such points in the United States of America as New York, Philadelphia, Pittsburg, Detroit, and other cities. The Cubans are particularly enthusiastic with regard to the progress of wireless telegraphy and telephony, while the Government affords every legitimate encouragement to foreign inventors to bring their ideas before its notice officially. It may, perhaps, be pointed out, however, that this is not a particularly auspicious moment for British contractors to enter into commercial arrangements with the Cuban Government, whose position is rendered insecure owing to internal disturbances and the threatened interference of the United States Government, due to charges of corruption and faulty native administration which have been rightly or wrongly, brought against the present Government.

On the other hand, the present is considered a specially favourable opportunity for British electrical engineers to take up extension and new contract work in South America owing to the more favourable position of British manufacturers, in comparison with that of American companies, French companies, and German contractors, owing to the effects of their depreciated currency on cable costs. The office of origin usually collects the entire charge for messages for wire and radio communication filed with it, balancing accounts at regular intervals with connecting companies. In the United States, all payments are made in dollars; but in France accounts for cable service are settled in francs at an exchange rate that produces a dollar value of less than 50 per cent. Thus, the cost of cabling is 25 cents per word, and the return message is paid for at 11.6 cents per word. The result is that American cable companies have lost money on westbound traffic from France, while a similar situation exists in Latin America, where the currency has a depreciated value in dollars. It is not difficult to understand why the position of the United Kingdom should be a favourable one. British companies connecting in South America with a French cable have solved the exchange difficulty by exacting payment in sterling or francs at the current rate of exchange. The action of the French Government in fixing the value of the franc for telegraph tariffs has been accelerated by the heavy deficit of the Administration of Posts and Telegraphs for 1921, amounting to nearly 2,000,000,000 fr. As the franc is the unit for telegraph tariffs, under the conventions of St. Petersburg and London, the establishment by France of a fixed currency value for the gold franc is likely to be followed by similar action in other signatory countries having depreciated paper currency, and may even have some effect on international tariffs in general.

NOTES FROM INDIA.

(From Our Special Correspondent.)

Darjeeling.—Government has notified in a recent *Gazette* that land in the Darjeeling district is likely to be needed for the construction of an electric power line from the Balasan River to Kurseong. The line will, it is surmised, pass through the Darjeeling and Kurseong Tea Gardens so as to enable planters to make use of motors for driving tea machinery all through the manufacturing season.

Kurseong is a popular little hill station at an altitude of about 5,000 feet, where a fair load for hotel, school and road lighting might be counted on, and also a good load for railway workshops and bungalows. Eventually it is hoped that it may be possible to electrify the Darjeeling Himalayan Railway—a narrow-gauge tortuous line of about 50 miles, between Siliguri and Darjeeling, which is 7,200 feet above sea level. This latter hill station, it may be noted, has a pioneer hydro-electric plant, put down as far back as about 1900. It was a small affair with an awkward periodicity for motors, but it has worked very successfully, and does credit to its designer and to all concerned in its running and upkeep since it was first installed. Very many isolated water-power electric plants are to be found on tea plantations in the Darjeeling and Kurseong districts, but all suffer from the same complaint—scarcity of water during the dry season from March to the end of June, when the monsoon rains flood the hill streams again and a plentiful supply may be counted on for at least six months.

Delhi.—Much controversy has recently taken place as to whether the new Delhi Capital scheme should be continued. Millions have already been spent on buildings, roads, drainage, and electric light and power, but it is argued on various grounds that even at this late hour—the work has been in hand now for about 10 years—it will be more economical in the end to abandon the project than continue lavishing money, that can ill be spared, on a capital which nobody wants. In spite, however, of these arguments, Government has no intention at present of stopping the work, and the construction of Government House, the new Secretariat, and numerous other incidental buildings is being proceeded with actively. Miles of underground cable are being laid, and new transformer stations are being built; and, when completed, the arrangements which are being made for street, road, and avenue electric lighting should eventuate in a very fine scheme indeed. As the policy of the Indian Government is to encourage as far as possible Indian industrial development, it is anticipated that all the poles and castings for this work can be satisfactorily made in India.

Insulators.—A new and very up-to-date pottery work

in Bengal is now manufacturing a large proportion of the insulators required for India, both for Government and for private work. Insulators for 10,000-volt transmission lines have been successfully made, and orders are pouring in to the works from all over the country. Also such trifles as switches, distribution boards, cut-outs, &c., are being turned out by the hundred gross, and special machinery for stamping terminals has been laid down. Undoubtedly British manufacturers of kindred material will feel the influence of this new factory upon their order sheets; but it is inevitable as time goes on that, aided and encouraged by the Government, more and more of the simpler type of electrical requirements will be locally produced. Attempts have been made to manufacture small motors, but it cannot be said that the results have been striking.

THE EFFECT OF WATER-POWER DEVELOPMENT ABROAD ON OUR MANUFACTURING POSITION.

By W. T. WARDALE, A.M.I.E.E.

The modern development of large water powers in all parts of the world sometimes gives rise to the question as to what will be the result of this development on our own position as a manufacturing nation. Will the power so developed involve the gradual slipping away of markets which we now hold, and the establishment of similar industries within economical distance, as regards power transmission, of the great waterfalls?

At first sight this seems to be an inevitable corollary of the above-noted water-power development, and it is quite certain that a good deal of work will in future be carried out in such countries as Sweden, New Zealand, and India, which in the past has been the monopoly almost of the coal-producing countries.

Iron, for instance, can be extracted and worked *electrically* at a much cheaper rate in Sweden than in our own country on account of Sweden's water-power resources; and it is quite a reasonable idea to consider that in the near future, steel for ship plates, boiler plates, and bridge building, may be produced there at a cheaper rate than in this country under the present conditions. India is prepared to supply herself with steel and also with cotton goods of certain qualities, and is making good progress with further works of a similar nature; and wherever iron ore, water power, and a sufficient supply of refractory materials can be found in close proximity, the iron trade will tend to centre and to expand to the limit of the water power—but scarcely any further.

This point, the limitation of water-powers, seems to be overlooked as a rule when Cassandra-like prophecies of our own early industrial extinction are indulged in; but it is a very real limit, and one which in the case of Switzerland, and certain portions of the Western States of America, has been experienced already.

In the States several of the plants near to the Mexican border have experienced the limitation of output alluded to, and have had to consider the installation of fuel-driven machinery, placed not near the falls of the rivers, but well down towards where the great towns lie, and where ample water can be secured for condensing purposes, and coal or oil delivered by train or barge at a reasonable cost. This limit must be reached at every water-power site sooner or later, and, owing to the development of those activities which always follow the establishment of a cheap source of power, the lands so favoured will become more and more power-using countries than they have been in the past. Thus, for some time, we ourselves should be busy in manufacturing and equipping plant for steel works, cotton mills, and shipbuilding yards, in order that these people may have such plant and tools to start working with; for at present many of them have not the experience to make and erect their own. Here, again, these activities will lead to money being handled by the native population in considerably larger sums than has been the case; and they will demand more and more of those things which we and other countries have to offer, and which they, at present, do not or cannot make. The low-paid labour of these lands will also assist us in the handling of the problem, for it is quite certain that when once the works indicated are started, native labour will find itself at a premium in many lines, and will have to be remunerated on a higher scale than has been the case; just as in Finland and other European countries, the establishment of a regular market in any one line as a result of good power facilities, will soon tend to lift the wages level to that of the highest-paid lands in Europe, and so assist to equalise matters somewhat as between one country and another.

The effect will come gradually, as, owing to the demands of railways in the newer countries, we ought to experience a fairly good time in making generating, transmitting, and running plant for these concerns, and in keeping our ships busy in taking plant to them and bringing food, wool, and other products home again.

Our own coal-producing and handling trade will have to come into line, produce with modern plant, in modern ways, and cease to look upon the trade as a means of holding the country by the throat, either for the purpose of wringing profits out of the nation or of making it pay higher wages than industry can stand. Unless this be done, and done willingly, the products of the works situated in countries having abundant water-powers will come here in larger and larger quantities, whilst the demand for coal will shrink until half our pits cannot find a market for their output; to some extent this is already being experienced as the result of the trade slump and of the equipment of a proportion of our best ships with oil fuel-burning apparatus. The equipment of the pits with the speediest and most modern types of coal-cutting and coal-handling plant will do a good deal to bring down our own fuel costs as a manufacturing nation; whilst the extended use of low-temperature carbonisation plant will tend to give us a good, cheap, and clean fuel, and to save for us those valuable by-products which at present are so often destroyed in boiler furnaces, and which we cheerfully buy from abroad when we might make them at home, saving ourselves a considerable sum of money annually, and providing work for large numbers of our population.

The development of the water-power abroad, therefore, will tend to make our own industries modernise their plant and methods or remain idle. Should this latter phase of the matter be developed by the reluctance either of owners to spend money in modernising their plant or of the men to give a good output per man per day, then it may be taken that these manufacturing plants will not stand idle any longer than will suffice to bring down their shares to a give-away price; they will then be snapped up by enterprising men, who will re-equip the plant and train men to carry out what will be virtually new processes which our present men will not understand, because they have refused to do so.

When the limit of the water-power development in any such country is reached, it will then possess a population which has changed from one which led a fairly primitive type of existence, to a community demanding most of the amenities of modern civilisation; owing to the development noted, their own land will only be able to supply a portion of those services and commodities, the rest having to be found from those countries which possess coal or oil fuel in fair abundance and under fairly workable conditions.

It has been stated that the end of the present supply of oil fuel can be already observed; as our own coal deposits may last for some considérable time to come, it follows that with the loading up of the world's large water-powers, the demand for manufactured goods will come back to those countries not only having good natural coal supplies, but which have the benefit of being situated within the temperate zone in which men can work at a reasonable output in comfort all the year round.

The tendency outlined above can be observed in Europe, in Sweden, where industrial activity is increasing as the result of water-power development, and in India, where steel works and cotton mills are being run under native management, with power from their large watersheds. The other portion of the matter has two sides to it; one, the spectacle of Switzerland having to consider the encouragement of all-night working in some of her industries because the available *economic* water-power development has been reached, and also in the States, where the use of automatic inductor generator stations, situated in adjacent valleys, and tapping small sources of water-power, has been brought to a considerable degree of efficiency; these plants requiring practically no supervision, making use of a cheap and hardy type of generator, and feeding into the main ring at points convenient to the valley and the general supply. The second consideration on this side of the matter is the fact that in our own country we possess large quantities of easily-won refractory materials, which make the working of iron and steel efficient and easy; and these refractories and fluxes are, as a rule, situated in fairly close proximity to the steel and iron-producing centres. Also, the valuable natural asset possessed by South-East Lancashire in particular, in having a naturally humid climate, means that textile goods of fine quality can be spun and manufactured with higher efficiency than in any other part of the world, and that textile engineering will always tend to centralise in that area.

The development of foreign water-powers should therefore make us busy as a manufacturing nation in building plant to be used in conjunction with these power supplies, should make our coal and iron trades recognise that there must be an end to exploitation of the nation for the benefit of a particular industry, and by the time the water-powers are gradually developed to their full extent, should give us ample markets containing large populations demanding our goods, because their own lands have gone beyond the economic limit of their own home production.

ELECTRICITY SUPPLY IN SOUTH AFRICA.*

Electricity Commission and Control Board.

The decision of the Government of the Union of South Africa to commence the electrification of the country's railways during a period of acute financial stringency was a momentous one, but that it was justified would seem to follow from the fact that it is estimated that the financial result of the electrification of one of the initial sections alone will be a saving in working expenses, as compared with steam traction, of no less than £237,510, or 215 per cent., on the net capital outlay.

It will be remembered that in 1917 Messrs. Merz & McLellan, consulting electrical engineers of London, were commissioned to consider the subject, and their report was submitted to the Union Parliament in September, 1919. The Railways and Harbours Board and the Government approved of the proposals made therein and a commencement of the work of conversion was made early this year. The scheme is understood to be one of the largest outside the U.S.A., and the first two sections to be electrified will afford experience of electric traction as applied to both suburban and main lines; the Howick branch line of 2¾ miles, which diverges from the Glencoe Junction—Pietermaritzburg section at Merrivale, will be worked on the multiple-unit system, while the Glencoe Junction-Pietermaritzburg section of the Natal main line, 171 miles in length, will be operated by means of electric locomotives.

In adopting the railway electrification scheme the advantage of modernising methods of transport was the main, though by no means the only, consideration, for the scheme was regarded not merely as a means of improving railway haulage, but as the beginning of the electrification of the country as a whole. Reasons of economy, therefore, dictated that the electricity generating stations which it would be necessary to establish to meet the railway demands should also supply electricity for municipal, industrial, and general purposes within the economic radius of the transmission system.

The Government realised this fact, and accordingly instructed Messrs. Merz & McLellan to investigate the general subject of electricity supply in the Union. The resulting reports were issued in April, 1920, and November, 1921, and the views expressed therein induced the Government to decide on the centralisation and the generation of electricity, and to establish regional systems of generation and distribution for all purposes. The necessary interlinking of the systems will be facilitated, it is hoped, by legislation that is alluded to below, which also provides that future developments shall be along such lines as will ensure "an abundant supply of electricity at the lowest possible cost."

The work involved is considerable and important as it will be realised that the Government and people of South Africa have embarked on one of the most important and far-reaching development schemes that have been undertaken since the establishment of the Union. Funds have already been provided by Parliament for the initial portion of the work, the gross capital outlay on which is estimated at £4,453,690—and this is only a small portion of what the whole scheme promises to become. "A country possessing such valuable raw materials, situated as it is far from other industrial countries, seems bound to develop a number of new industries of this kind as soon as cheap power is available."

In a report dated January, 1916, the Development of Resources Committee of the South African Institute of Electrical Engineers drew attention to the remarkable opportunities for the manufacture, with the aid of electric power, of articles of commercial value extensively used by the agricultural and mining industries in South Africa. The latter industries utilise annually more than two million pounds' sterling worth of chemicals which at present are imported. The necessary raw materials are available in the Union, and with the provision of cheap power supplies South Africa will possess all the essential requirements for electro-chemical industries on a large scale.

By-product recovery from waste coal will be a feature of all super-power stations in future, and the consulting engineers have been asked to consider the advisability of designing the power stations to be built in connection with the railway electrification scheme, so that the necessary plant for the recovery of by-products can be added.

In England in 1920 the Nitrogen Products Committee appointed by the Ministry of Munitions reported most favourably on the prospects of coal by-product recovery in South Africa, and the distribution in bulk of cheap power should stimulate industrial activity and production and create a new spirit of enterprise in potential industries. To facilitate its intentions the Government drafted an Electricity Bill early in 1921; however, the drafting committee did not follow its instructions to frame the Bill on the lines of the Electricity (Supply) Act, 1919 (Great Britain) as recommended by Messrs. Merz and McLellan, and the result of its shortcomings was that the Bill was withdrawn entirely. The Bill was re-drafted and introduced as the Electricity Bill, 1922, when it was seen that much of the criticism of the first measure had been met.

The Bill provides for the establishment of an Electrcity Supply Commission, to consist of not less than three and not more than five members, appointed by the Governor-General, who shall fix the term of office, salary, and conditions of appointment; at least one member shall give his whole time to the work of the Commission, the duties of which shall be:—

"(a) The establishment, maintenance and working of undertakings for an efficient supply of electricity, at as low a cost as possible, to Government departments, the S.A.

* This article is based on information obtained from the following sources: The High Commissioner for the Union of South Africa; Reuter's Trade Service; the *S.A. Railways and Harbours Magazine*; the *S.A. Mining and Engineering Journal*; and the *Transactions* of the S.A. Institute of Electrical Engineers.

Railways and Harbours Administration, local authorities, companies, and other persons carrying on industrial undertakings, or any other persons whatsoever in the Union; "(*b*) the investigation of new or additional facilities for the supply of electricity within any area and the better co-ordination and co-operation of existing undertakings, so as to stimulate the provision, wherever required, of a cheap and abundant supply of electricity."

The Commission will have power, *inter alia*, to (*c*) raise money by way of loan; "(*d*) acquire by purchase, lease, or otherwise, land or rights or interests in or over land, water rights, rights to coal, and to property of any description whatsoever, and to work or otherwise beneficially use any property or rights so acquired; (*e*) acquire by purchase, lease, or otherwise, or to construct and to maintain, alter, or improve buildings, machinery, plant, transmission and distribution lines, waterworks, reservoirs, railways, roads, bridges water-courses, pipe-lines, and any other apparatus or works; . . . . (*k*) purchase or sell coal or other fuel, steam, water, and other materials and stores; (*l*) manufacture and sell any by-products incidental to the efficient carrying on of any work or undertaking which is within its duties, functions or powers."

Before the Commission can establish or acquire an electricity undertaking a permit therefor must be obtained from the Electricity Control Board and the Minister of Mines and Industries must approve of the scheme; the Governor-General can then authorise the Commission to raise by way of loan the capital necessary for financing the scheme. Should it appear that any undertaking established or acquired by the Commission can be more advantageously worked by another undertaker than itself, the Commission can (with the approval of the Governor-General and the Electricity Control Board) call for tenders for the working of the undertaking. It shall be the principle of the Commission that its undertakings shall be carried on neither at a profit nor loss, and its charges for electricity shall be adjusted accordingly.

For the purpose of controlling the supply of electricity by the Commission the Minister of Mines and Industries shall designate no fewer than three or more than five persons to be an Electricity Control Board, which shall have all the powers, jurisdictions and privileges described in Act No. 6 of 1918.

Neither the Commission, nor any person, company, or association, shall carry on or engage in any manner in any existing or future public electricity supply undertaking except by permission of the Electricity Control Board. But no such permit shall be necessary to authorise the generation or supply of electricity by any Government department, or the S.A. Railways and Harbours Administration, any urban local authority, or any undertaking the rated capacity of which is under 500 kW per annum. Any person or association may, without a licence, generate for his or its own use any quantity of electricity, but the supply thereof shall comply with any requirements of the Electricity Control Board made to facilitate co-ordination with other existing or future undertakings. Such a person or association, a Government department, and the S.A. Railways and Harbours Administration, may also supply electricity to other persons, up to 1,000,000 kWh per annum, without needing a licence for the generating station. A licence other than one held by the Commission shall contain a schedule of standard prices chargeable by the licensee, and surplus profits shall be shared with consumers. An appeal can be made to the Electricity Control Board in the case of delay or refusal of the licensee to supply any applicant, and 38 years after the granting of a licence the Governor-General may, subject to two years' notice, expropriate the licensed undertaking on payment of the value thereof at the time of expropriation, no allowance being made by reason that the purchase is compulsory, for goodwill, prospective profits, or similar considerations.

The generation and distribution of electricity within an urban local authority's area shall be under the control of that authority, but the Electricity Control Board's permission shall be necessary for such an authority to supply electricity outside its area; no person or body shall supply electricity within a local authority's area without the latter's consent.

In cases of appeals against the decisions of the Electricity Control Board the decision of the Minister of Mines and Industries shall be final, and with regard to the penalties for contravention of the Act, it is provided, *inter alia*, that an undertaker shall be liable to a fine not exceeding £50 for every day that his failure to comply with the provisions continues, and, in addition, he may be ordered to forfeit the whole of the net revenue derived from the undertaking.

This Bill passed through Parliament before the end of the session in July last. "The general principle of the Bill could not be altered in Select Committee, and the two authorities—the Electricity Supply Commission and the Electricity Control Board—remain as in the original draft; but with vital differences in their constitution. It was feared by many that the Railway Administration might desire to obtain a dominating influence on both these bodies for its own purposes, which would have been highly undesirable for many reasons. The objection has been met by the Select Committee, and no official in the employ of the Railway Administration can now be appointed either to the Supply Commission or to the Control Board. Appointments to the Control Board, too, need no longer be made solely from the Civil Service, though Civil Servants may still be members of the Board. The main criticism against the original Bill was that it gave the Supply Commission special privileges against other undertakers, which might effectually close the door against private enterprise. The criticism has been faced boldly by the Select Committee, which has introduced the important principle that, before establishing any new undertaking, the Commission shall call for tenders, which shall be referred to the Control Board and the Minister. Only after expert advice on them has been given, and after the most careful consideration, shall the Government decide between the Commission and any tenderer. There is, too, an additional safeguard now: Five years after the Commission has established an undertaking, or later if the Minister of Mines and Industries is of the opinion that such an undertaking might be more advantageously worked by another undertaker, tenders for its operation are to be invited. The new provision is, perhaps, the best practical method that could be devised to ensure economical working. The original clause empowering the Commission to differentiate in its charges as between various classes of consumers—a privilege expressly denied to other undertakers—has been deleted, and the Commission is now rightly placed in the same position as other licensed undertakers. A schedule of standard prices will be fixed, subject to periodic revision by the Control Board. These are the main modifications which have been introduced into the Bill. As to the desirability of the Bill in principle there is no controversy, and everyone will hope that it may achieve its essential object of enabling the railways and other industries to obtain cheap electric power."

The magnitude of the task of electrifying the country's railways is indicated by the following figures: Less than 60 years ago there were no railways in South Africa, but, according to Sir W. W. Hoy (general manager of the S.A. Railways and Harbours), there exists to-day a network of 15,000 miles of railways in the Union and adjoining territories, the longest through route being from Cape Town to the Belgian Congo, a distance of 2,600 miles. Since the establishment of the Union on May 31st, 1910, the open mileage of the State-owned lines has increased by 2,650 miles, or 39 per cent., while the mileage worked has increased by nearly 4,000 miles, or roughly 53 per cent. The capital outlay on the system amounts to £100,000,000, having increased by 37 per cent. since 1909, and the general traffic development during the same period is reflected by the following increases: Train-miles, 16,312,000, or 83 per cent.; passengers carried 36,000,000, or 127 per cent.; tonnage of goods carried 3,748,000, or 100 per cent.; tonnage of coal carried 3,752,000, or 72 per cent.; total earnings £13,162,000, or 126 per cent.; earnings per average open mile £940, or 126 per cent.

The physical features of the country traversed by the South African railways vary greatly; on the main lines from the seaboard to Johannesburg the ruling gradients are 1 in 40 in the coastal region, and 1 in 80 inland, whilst the sharpest curve has a radius of 300 ft., and the highest altitude reached is 6,463 ft.

With regard to the general supply of electricity in the Union the Summary of Sir R. N. Kotze (Government Mining Engineer) presents a fairly accurate picture of the present position:—

The only undertaking in South Africa which generates and sells electricity on a scale comparable to that of the world's largest undertakings is the Victoria Falls & Transvaal Power Co., Ltd. With its subsidiary company, the Rand Mines Power Supply Co., Ltd., it supplied, during 1921, 804,000,000 electrical units from its four generating stations at Rosherville, Simmer Pan, Brakpan, and Vereeniging, which have a total plant capacity of 219,500 kVA. Its consumers are mainly gold mines on the Witwatersrand, but some of the municipalities on the Rand also purchase a bulk supply from it, and there are sundry other consumers, such as factories, steel and iron works at Vereeniging, &c.

Before the days of the Victoria Falls Power Co. nearly all the mines on the Rand generated their own electricity, and its principal use was for lighting purposes. The close association of some mines led to the establishment of central stations for groups of mines, and to this class belong the stations of the Randfontein Estates (26,000 kW), the East Rand Proprietary Mines (22,000 kW), and the Kleinfontein Association (6,000 kW), which supply electricity for both light and power, and which to some extent also sell power to neighbouring municipalities and a few other consumers. The central power station (17,000 kW) of the De Beers Co., at Kimberley, had a similar origin, and, besides supplying the needs of the mining company itself, furnishes light and power, to the extent of three and a half million units, to the municipality and tramways of Kimberley.

The other companies selling electricity all operate on a smaller scale and generate mostly for their own use. Two

of these in the Transvaal, the Transvaal Gold Mining Estates and Glynn's Lydenburg, are mining companies with hydro-electric plant run on water power granted under the mining laws of that Province, and sell part of their electricity to other mining concerns and to the townships of Sabie and Pilgrim's Rest.

The larger municipalities have generating plant of their own, both for town lighting, for selling to consumers for light and power, and, in the case of several of them, for running tramways. The installations with a rated capacity of over 1,000 kW are the following:—

	kW Capacity.
Johannesburg	13,750
Durban	10,000
Capetown	8,900
Port Elizabeth	3,500
Pretoria	3,200
Pietermaritzburg	2,200
East London	1,700
Bloemfontein	1,650

There are a further 33 municipalities with plant of a capacity mostly under 200 kW. Of other public undertakings of importance mention should be made of the two tramway companies in Capetown, which operate the city and Camp's Bay tramways. They use about five and a half million units per annum, which may be considered as equivalent to a capacity of about 2,500 kW. The Port Elizabeth Tramway Co. has a plant of 900 kW, and uses about 1,000,000 units per annum.

The South African Railways and Harbours Administration has, at the present time, before electric traction is adopted on any of its sections, a fairly large demand for electric power. Its 15 principal workshop and harbour depôts and 160 smaller installations are completely electrified, while the lighting of these and of railway premises and the charging of accumulators for coaches gives rise to a large demand. Over 20,000,000 units were consumed in 1921, and the major portion of this power was purchased from municipalities and transformed or converted as necessary. Durban supplied five million and Capetown four million units. The Pretoria demand of about one and a half million units is at present met by the Administration's station, but arrangements have been made to secure this and a much increased supply from the Pretoria Municipality's new plant. The Administration produces its own electric power at Uitenhage, De Aar, Beaufort West, Touws River, and Standerton. At these last-quoted localities the Administration also fulfils the requirements of the municipalities for a supply of lighting, but otherwise it is not its practice to sell electricity.

The remaining producers of electricity in the Union are private persons and companies who generate it for their own use. Some of these, such as the larger diamond, gold, and coal mining companies, have fairly large-sized plant, the Premier Diamond Mine's plant, for example, being rated at 3,915 kW. The total number of such establishments is given by Messrs. Merz and McLellan as 1,477, with a rated capacity of 115,171 h.p. From the statistics published by the Department of Mines and Industries for December 31st, 1919, it appears that there were in use in South Africa 13,458 electric motors of 595,702 total h.p., and of these 6,289 motors of 120,760 h.p. belonging to industrial concerns, as distinguished from mines.

As might be expected, the type of current adopted in South Africa varies a good deal. The Victoria Falls and Transvaal Power Co., the Randfontein undertaking and the municipalities of Durban and Bloemfontein have three-phase current, with a frequency of 50. Capetown and Johannesburg municipalities both have a two-phase, 50-cycle system and also direct current. Pretoria has direct current only. The smaller municipalities have mostly adopted direct current.

Prices paid naturally show great variation. The Victoria Falls Co. charges .525 penny per unit to consumers with a load factor of 70 per cent. and over, and a higher rate for lower factors. For supply to municipalities the company's tariff varies with the period of contract, and is built up of a charge proportional to the number of kW taken at the peak load and a charge on the units actually consumed. Provision is made in the company's licence for sharing surplus profits with consumers.

The larger municipalities have experimented in various forms of tariff, with more or less success in extending the consumption, but there appears to be little unanimity amongst their engineers as to the best policy to adopt. Moreover, all the larger municipalities are hampered by the need for larger supply stations, and have to adopt their policy to suit this element in the situation.

South Africa cannot boast of water-power resources in the slightest degree comparably to those of Canada. In the Victoria Falls of the Zambesi and the Aughrabies Falls of the Orange River are no doubt potential sources of a large quantity of power, but they are situated in areas at present remote from any considerable population, and it will be many years before they are utilised. There are in the Transvaal, Natal, and the Eastern Cape a number of streams from which power could be generated, but their size, situation, &c., do not encourage the belief that anything but comparatively small amounts of power could be generated from them. These will be useful in time, and should be linked up with any general scheme of power supply to embrace the whole country, but they are more likely to be of local use than for transmission to distant consumers.

As against the "white coal" of Canada, South Africa has, in the Transvaal and Natal, and, to a less extent, in the Orange Free State, vast supplies of coal, which can be won at as low a cost as anywhere else in the world, and it is on this source of power that the country must rely. The initial cost of steam-driven generating stations is, of course, high, and the amortisation and interest on such plant alone constitute a heavy charge per unit for current supplied. Still, fuel supply is the next most important item of working expenditure, and ultimately a process may be evolved which will consist in the winning of by-products from coal and the utilisation of the balance, either directly or as producer gas, as fuel. This should yield electricity at a fairly low cost per unit.

For the present and in the immediate future South Africa must rely on coal as the source of power for any large generating plant.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JULY, 1922.

It will be noted with interest that the July returns of electrical exports from this country show a slight improvement; the total value recorded for the month was £809,915, as compared with £782,656 in June.

The electrical imports total of £184,979 for the month, as compared with the June figures of £202,481, represents a bigger falling off in value than in the previous month.

The re-exports, valued at £15,246, show a marked increase as compared with £11,543 recorded for June.

The increased value of the exports was due principally to improved business in the insulated wire and cable and telegraph and telephone wire and cable sections, while the figures for lamp exports show a falling-off of £9,000 as compared with June. In the electrical imports section the machinery totals were nearly £40,000 less than those for the previous month; an increase, however, of £20,000 was recorded in the telegraph and telephone imports section.

Values of Electrical Exports and Imports for July, 1922.

	Exports. £	Imports. £	Re-Exports. £
Electrical goods and apparatus	86,168	35,982	3,262
Insulated wires and cables ...	138,588	11,338	36
Glow lamps	19,491	12,970	216
Arc lamps and parts	690	928	—
Batteries and accumulators ...	43,630	3,591	95
Carbons	3,554	3,205	259
Meters and instruments ...	17,125	6,148	2,783
Electrical Machinery.			
Railway and tramway motors...	20,594	—	—
Other motors and generators ...	136,012	—	—
Switchboard (not telegraph or telephone)	5,889	280	—
Electrical machinery (unenumerated	117,035	74,642	6,411
Telegraph and telephone cable and material.			
Telegraph and telephone wire and cable (not submarine) ...	61,756	2,010	667
Submarine telegraph and telephone cable	24,110	—	—
Telegraph and telephone instruments and apparatus ...	135,273	33,885	1,517
Total	£809,915	184,979	15,246

Glasgow Tramways Jubilee.—The city of Glasgow celebrated the jubilee of the tramways on August 18th with a pageant showing ancient and modern types of vehicles. At a luncheon which followed the toast of "The Corporation of Glasgow" was proposed by Alderman Clark, of Rochdale. Other toasts were "The Tramways Committee," by Councillor Mancor, Convener of the Edinburgh Tramways Committee, replied to by Bailie McWhirr, Convener of the Glasgow Tramways Committee; "The Staff, Past and Present," by Sir W. F. Russell, replied to by Mr. Barber Glenn, first secretary of the Glasgow Tramway Co.; Mr. John Young, general manager, Glasgow Corporation Tramways, 1894-1904; and Mr. James Dalrymple, the present general manager. In the evening a reception and dance took place, and every employé was presented with a one-pound Treasury note.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Portable Starter for Large Petrol Motors.

We recently attended a demonstration of an appliance invented by Mr. G. F. Whipple, 38, Newton Road, Rushton, Northants, for starting up the engines of vehicles of the charabanc type. This consists of a small electric motor which drives, through a single reduction gear, a shaft which is secured to the starting handle of the engine. The arrangement is shown in the accompanying illustration (fig. 1). As will be seen, the shaft passes through a ring mounted upon the motor, and it is held by three springs, which take up any displacement in any direction. A universal joint in the centre of the shaft performs a similar function. To the end of the shaft is fitted an arm, one end of which hooks over the front of the starting handle, while a semi-circular recess at the opposite end fits over the other end of the starting handle. The starting dogs are put into gear by means of a lever which pushes the shaft forward. The whole gear is mounted on a simple trolley, the wheels of which, when it is placed in position, are lifted clear of the floor by the lever seen upon the right of the appliance.

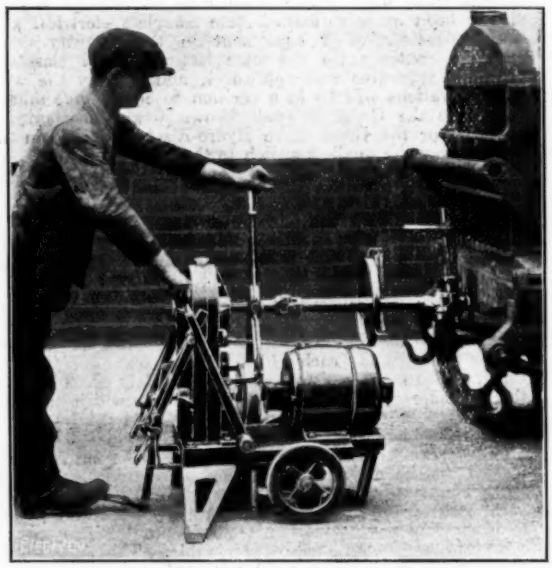

Fig. 1.—A Portable Petrol Motor Starter.

In depôts where it is necessary to start a number of large engines from "cold" every morning, the starter should prove of great utility.

A 5-cwt. Electric Delivery Van.

A small electric delivery van (fig. 2) for loads up to 5 cwt. has recently been put on the American market by the Automatic Transportation Co., of Buffalo, N.Y. It is propelled by a 24-volt, 35-ampere, series-wound motor located under the driver's seat and driving the near side rear wheel through the medium of a roller chain. Power is supplied by a battery of "Exide" accumulators, while the controller is arranged to give five positions, *viz.*, three forward speeds, a neutral position, and a reverse motion. The body of the van has a loading space of 3 ft. 5 in. by 3 ft. 2 in. by 3 ft. 11 in., equal to 38 cu. ft. The vehicle, which has a wheel base of 5 ft. 5 in. and weighs 9 cwt. complete, is fitted with 26-in. dia. wheels and 3-in. pneumatic tires.

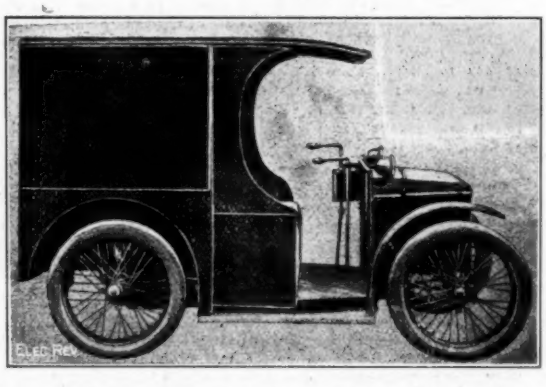

Fig. 2.—A 5-cwt. Electric Delivery Van.

The "Electri-Gas" Range.

The Magic Furnace Co., Boston, Mass., U.S.A., whose electric coal range was described in the Electrical Review of November 25th, 1921, has now produced a similar appliance in which both the electrical and gas methods are employed.

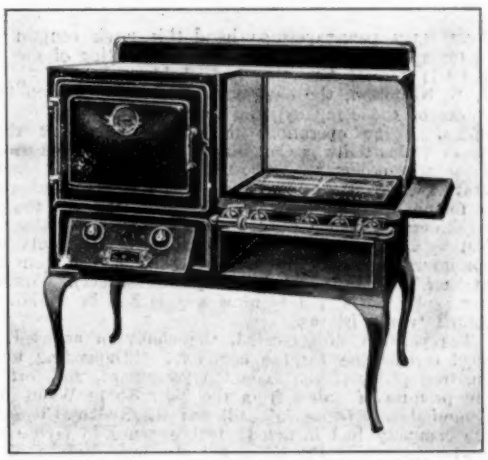

Fig. 3.—The "Electri-Gas" Range.

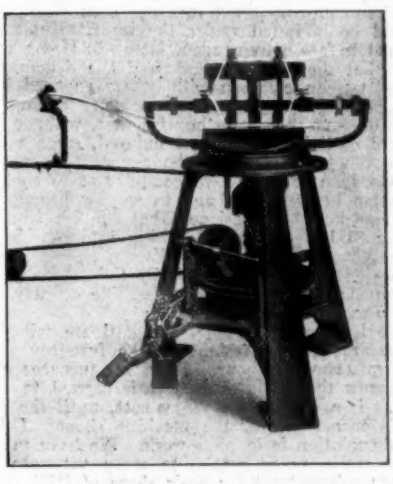

Fig. 4.—The "Quickway" Coil Forming Machine.

The electrical half consists of an oven measuring 18 in. in breadth and depth, and 14 in. in height, an electric grill, and an "outlet" receptacle for the operation of a washing machine, an electric iron, or other appliance. The gas half, which is on the right of the illustration (fig. 3), consists of five burners fitted beneath a perforated table. The gas is lighted electrically by the mere pressing of a button.

The "Quickway" Coil-forming Machine.

The Midland Dynamo & Motor Repairs Co., Ltd., Volta Works, 64, Belgrave Gate, Leicester, has sent us particulars of a new machine for winding and forming coils which possesses the merits of simplicity and ease of operation. This machine, known as the "Quickway," is illustrated in fig. 4. It is adjustable and can be sets up to the required dimensions of the coil in a few minutes. The conductors are arranged to be drawn through a friction clamp which adjusts the tension. The winding position of the machine is such that the wires require practically no handling as they are being fed into position. By means of a friction clutch the machine revolves and draws the wire along the track to form a hair-pin loop which has sides arranged at an angle to suit the slot in the armature which the coil is to occupy.

E

When the requisite number of turns has been made, by the simple movement of a lever through the friction drive, and by the same mechanism, the coil is stretched ready for taping. The time occupied in winding an average coil is two minutes. The advantages claimed for this machine by the inventor are its speed, simplicity, and efficiency; no wooden blocks or other accessories are required; the machine is a complete unit; and it will deal with all sizes of wire wound stator or armature coils found in practice. The machine is power-driven and can be directly coupled to a small high-speed motor, or shafting.

THE ELECTRICAL MANUFACTURING POSITION IN AUSTRALIA.

Australian newspapers to hand this week contain reports of the speech delivered at the annual meeting of the English Electric Co., of Australia, Ltd., held on June 15th, by Mr. J. B. Nicholson, the chairman. He first described the new works of the company, and the progress being made with manufacturing operations there. He said that the New South Wales Railway Commissioners had favoured them with substantial orders for turbo-alternators, some of which were nearing completion. In other directions they had not been so fortunate. An impression had got abroad that the class of machinery in which the company specialised, although subject to duty, might be allowed into Australia duty free by special regulation. Evidently "pressure had been brought to bear," and not only had importations been allowed duty free, but rebates of duty already paid had been allowed and refunds made in cash.

The position thus created, the chairman asserted, was a most serious one for the company. "Depending upon the declared policy of the Federal Government, and fortified by the promise of orders from the New South Wales Railway Commissioners (since fulfilled) and the Sydney City Council, the company had incurred great expense in laying out its works and equipping them for the manufacture of turbo-generators of large size and of assorted plant. They had felt confident that, with the assistance of designs and information supplied by the English Electric Co., Ltd., the Australian company could turn out such work as cheaply as it could be imported under the tariff. But not only had they had to face a tremendous slump in Home prices, but on top of that they had the action of the Federal Government referred to. In common with others engaged in the metal trades, the company expected to suffer during the present depression, but they were hopeful that, without reducing the standard of living at present enjoyed, some method might be discovered of arranging labour costs to meet competition, with the help of a tariff so compiled as to enable Australia to develop her resources and to employ her mechanics. In this connection he mentioned that English labour was paid 45s. for 53 hours' work. Taking into consideration hours of labour worked, labour costs there were just about one-third of those in Australia. Practically the whole of the cost of locally-made machinery was wages. The country produced all the raw material.

"The iron ore, limestone, and coal are mined by labour. Cartage, railage, or freight to the furnaces resolves itself into a question of labour. From the furnaces at Newcastle or Lithgow the pig-iron or steel is carried to the foundry. Again it is a question of wages cost, until the finished product is turned out of the machine shops. I believe that the only solution is in piece-work. We have to give a price for the work we undertake to carry out—why should not our men sub-contract for their share of it?"

At an extraordinary meeting which followed, a resolution was passed reducing the capital from £600,000 to £500,000 by cancelling 100,000 "A" paid-up ordinary shares of £1 each, which had been surrendered to the company. Mr. Nicholson explained that the company had made a deal with the holder of "A" ordinary shares, and through Standard Waygood, Ltd., had purchased them for £10,000. After the cancellation of these shares the item "goodwill" would disappear from the balance-sheet.

At about the date of the delivery of Mr. Nicholson's speech there was appearing in the Australian newspapers a prospectus of the Federal General Electric, Ltd., which was being formed with a capital of £750,000 in £10 shares, of which 60,000 (10 per cent. cumulative participating preference) were being offered for public subscription. The vendor and promoter were to take 14,000 ordinary shares of £10 each in part payment. The intentions of the company, as advertised, were to carry into effect an agreement between C. Mac McLeod, of Sydney, of the one part, and Wm. Buck, of Melbourne, of the other part, acting on behalf of the company. It was to establish and build commodious workshops near Melbourne, Victoria, for the manufacture of all classes of electrical appliances, including steam and hydro-electric generating equipment in all its several branches, dynamos, turbines, accumulators, fuses, magnetos, cut-outs, switchboards, converters, transformers, meters, and other measuring and recording instruments, regulators and rheostats, batteries, lighting sets, electric locomotives, railway and tramway rolling stock (electric) and appliances, electric furnaces, electric welding machines, and generally everything electrical.

The company was also to manufacture telephones, telegraph, wireless, and X-ray apparatus; and to lease, license or otherwise acquire rights, either separately or conjointly with others, to control, manage or otherwise water, coal and other schemes for the generation of electricity, to erect plant and equipment suitable for the purpose, and distribute, sell or otherwise dispose of the energy produced.

We quote from the prospectus the following optimistic forecast regarding the future electrical opportunities for economic manufacturing in Australia.

"Australia, and Victoria in particular, is rapidly developing enormous schemes for the supply of cheap electrical power, but, despite the fact that we produce the raw and manufactured materials in abundance no attempt has previously been made to manufacture complete electrical generating plant and other equipment in this country. This company contemplates the manufacture of all classes of electrical apparatus and appliances, and directly the works start operations will be in a position to equip huge schemes similar to the Great Morwell Brown Coal undertaking in Victoria, or the Great Lake Hydro-Electric Works in Tasmania, from the smallest switch to the largest generator. The company will be equally competent to manufacture electric tramway and railway rolling stock and undertake railway electrification similar to that in operation in Melbourne or the a.c. system. During the twelve months 1920-21, Australia's importations of the materials under review reached the colossal figures £3,281,164, and directly the electric supply schemes reaching the productive stage release their enormous power to the service of the community the importations will necessarily exceed these figures. The several schemes contemplate the production of several hundred thousand horse power and each 100,000 h.p. involves the consumers in an expenditure of approximately £26,000,000 in the purchase of motors and other services which this company will be in a position to supply. Assisted by a most substantial tariff and anti-dumping regulations designed to prevent overseas manufacturers competing in the Australian market to the detriment of the local industry, practically no opposition, a most up-to-date automatically controlled plant, and an enormous demand, both present and prospective, showing a substantial margin of profit, the company's prospects are exceptionably favourable. This fact induced the vendors to concede a 10 per cent. cumulative participating preferential dividend to the subscribers to this issue. The directors have full confidence that the company will successfully compete both as to quality and price with either foreign or interstate manufacturers, and that at all times the company will dispose of its total production at remunerative rates and more than adequate to maintain the payment of not less than 10 per cent. dividends."

"We would very much like to be making our own telephones, or having them made in Australia," Mr. Poynton, the Postmaster-General, is reported by the *Melbourne Herald* to have said. "But the trouble is," he continued, "that a fac- recently. "But the trouble is," he continued, "that a factory working solely on telephone material could turn out in one year more than would be required by us for several years, even though the demand for telephones is increasing. The only hope would be to comprise the manufacture of this line with something else. In this connection nothing of a practical nature has yet been placed before us."

Recently Mr. Poynton communicated with English firms, asking whether they would be prepared to inaugurate the manufacture of telephones in Australia. The replies received indicated that the firms would undertake the work provided they were guaranteed a certain amount over and above cost price—in other words, an assured profit. The Government did not see its way clear to agree to this. From time to time the department has been approached by company promoters, who sought assurances of Government contracts in the event of companies being formed to engage in the manufacture of telephones or telephone cable. In each case the department promised that it would give every assistance to local enterprise. So far, however, nothing definite has materialised.

The Italian Electrotechnical Association.—The 25th anniversary of the foundation of the Associazione Elettrotecnia Italiana will be celebrated at Milan on the occasion of the yearly meeting in October this year, to which representatives of foreign electrical associations will be invited. The meeting will last over eight days, and an interesting programme is arranged of visits to important stations and works in the neighbourhood, and of addresses on the drought crisis and its relation to electrical generation, modern high-speed hydraulic turbines, masts and standards for electric lines, aerial conductors, hung and pivoted insulators, dielectric losses in cables, protection against over-pressures, synchronous and autosynchronous motors, and static condensers.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Lightning Conductors of the County Hall.

In your description (August 11th) of the method of using the steel frame of the building as the connection from the points on the roofs to the ground, you remark: "it is believed to be the first example of this method of protection being adopted on a large scale." This plan was considered by the Lightning Research Committee and noted in its 1905 Report, and the Mersey Dock Board's Liver building was protected according to my specification as consulting engineer in a similar manner, which I also applied to the Royal Horticultural Hall and several other important buildings. It is gratifying to hear that the National Physical Laboratory has specified the method which was first installed at Liverpool.

Killingworth Hedges.

Westminster, *August 20th*, 1922.

The Village Power Station.

The communication from the secretary to the Electricity Commissioners, on page 195 of your issue for August 11th, is of interest to a considerable number of people.

The attitude of the Government, through the Commissioners, is difficult to understand. There are numerous small communities desiring to have a supply of electricity, whose situation makes it impossible for the national supply stations to reach them for the next ten or twenty years; and many other small towns and villages, which will always be outside the economical reach of the large schemes.

These communities first inquired about the matter, were told that the supply of electricity was being arranged for on a national basis, and were led to believe that they would be included in such provision. Then, on finding that after 3½ years practically nothing has been done for the large towns, they wish to install small plant of their own, which would in time become linked up to the larger scheme. Such plant is now forbidden to them; but they are told that if the supply is from a private, and not a public station, then they may go ahead.

Does this mean that if the local sawmills or corn mills install plant to light their own premises and provide some amount of power the sawmills may then sell energy to the village, as that will not constitute a public electricity supply? If so, it would be a good plan to make this plain.

During the last three years I have had to hang up, or have had hung up, owing to the do-nothing and dog-in-the-manger policy of the Commissioners, schemes which would have entailed orders for plant and overhead mains alone of well over £30,000; and still the game goes on, and still we pay doles to men out of work. Later on we shall pay doles to meet the loss on the national supply scheme, and then the Government no doubt will feel that the scheme really is launched.

Arcadia.

August 17th, 1922.

The Prospects for Young Engineers Abroad.

As an unemployed engineer, I am interested to know the possibilities of employment abroad, and if engineers with knowledge of conditions abroad would publish their views, I feel sure they would be of assistance to many.

What are the present-day prospects of employment for young technical men of limited experience with manufacturers, power companies, consultants, or railways in the United States, France, or Switzerland?

There are, of course, difficulties in the way, but emigration may be a solution of the problem of obtaining employment for those who cannot make any headway in this country.

Young Engineer.

London, *August 22nd*, 1922.

[We should be glad to receive information on this subject for publication dealing with the existing conditions not only in the countries named, but also in other foreign countries, and in the British Dominions and Colonies.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—Edward George Rowe, formerly trading as Davies & Rowe, electrical engineers and contractors, Tonypandy.—At Pontypridd Bankruptcy Court, on Saturday, the public examination was held. Debtor put his deficiency at £854, and stated that he had acted previously as a Post Office telegraphist. In February, 1919, upon demobilisation from the Army, he entered into partnership with Frederick Howell Davies, who had been formerly employed as a colliery electrician. They each put £20 into the business, which at first was successful. Eventually a slump in trade set in and creditors pressed. In March of this year the partnership was dissolved, the debtor paying £75 to his partner. A day book and ledger with debtors had been kept. The Deputy Official Receiver stated that sufficient money had been lodged with the Official Receiver to enable the creditors to be paid 20s. in the £, and costs of the proceedings, subject to a certain claim being withdrawn. The examination was closed, the Registrar commenting on the satisfactory features of the case.

Last day for proofs for dividend, September 6th. Trustee: Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff.

W. H. Borrows, engineer and electrician, Werrington, Northampton.—Receiving order made August 14th, on debtor's own petition.

W. Caldwell (Caldwell & Son), electrical engineer, 26, Victoria Road, Hale, Chester.—First meeting August 29th, at the Official Receiver's offices, Manchester. Public examination, September 15th, at the Court House, Manchester.

Joseph Ernest Rollinson, 5, Tavistock Chambers, Beastmarket Hill, Nottingham, electrical engineer and contractor.—The first meeting of creditors was held on August 21st, at the Official Receiver's offices, 4, Castle Place, Nottingham. According to the statement of affairs there was a deficiency of £643. It appeared that debtor was employed as an electrician until March, 1919, when he commenced business on his own account as an electrical engineer at his present address with £50 savings. He traded alone until February, 1921, when he was joined by a partner, who put in £400, but the partnership was dissolved in February last, debtor taking over the assets and liabilities, and continuing by himself. The liabilities were returned at £980, against net assets of £337. The creditors decided to appoint Mr. H. F. Holloway, of Messrs. Derbyshire Bros., as trustee, assisted by a committee of inspection.

A. J. Willcox, motor and electrical engineer, The Garage, Farnham Common.—First and final dividend of 4s. 6d. in the £, payable August 30th, at 28, Theobalds Road, W.C.1.

F. H. Dennis, electrical engineer, late of 20, High Street, Chelmsford.—Receiving order made August 19th, on debtor's own petition.

J. F. Ludlow & R. R. Ludlow (Ludlow Bros.), electrical contractors, 196, Church Road, Redfield, Bristol.—First and final dividend of 1s. 7¼d. in the £ payable September 1st, at the Official Receiver's office, 26, Baldwin Street, Bristol.

Dissolution of Partnership.—Messrs. J. H. Collie and Frank B. Cox (Collie & Cox, consulting and electrical engineers, 65, Fleet Street, Liverpool) have dissolved partnership. Mr. Collie will continue to represent Messrs. Brook, Hirst and Co., Ltd., and the British Insulated & Helsby Cables, Ltd., and will carry on business under his own name at 8, Harrington Street, Liverpool. ('Phone: "Central 5039.") He will attend to debts, &c., of the late firm. Mr. Cox will continue to carry on business at 65, Fleet Street, Liverpool, representing Messrs. Walter McGee & Co., Ltd., of Paisley ("Emcol" A.C. machines).

Sequestration.—The estates of the Auto Electrical Equipment Co., automobile and electrical engineers, 119-121, Bothwell Street, Glasgow, and J. R. Buchanan, the sole partner thereof, were sequestrated by the Sheriff of Lanarkshire on August 18th; meeting to elect the Trustee and Commissioners August 29th, at the Faculty Hall, St. George's Place, Glasgow. A composition may be offered at this meeting. Particulars of claims by December 18th to Mr. W. Hutchison, agent, 223, St. Vincent Street, Glasgow.

Scheme of Arrangement.—The Westminster Engineering Co., Ltd.—In our issue of July 21st we referred to meetings which had been called at which the different classes of shareholders would consider a scheme of arrangement between the company and themselves. We are asked to state that the arrangement referred to was simply a matter of converting the founders' shares into ordinary shares, and no reduction of capital was involved.

Trade Announcements.—Messrs. M. K. Cooper & Co., of Chapel Walks, Liverpool, have removed their offices to 11, Redcross Street, Liverpool. Telephone No.: "Bank 3924." They desire to receive price lists for electrical household utensils.

The Jeary Electrical Co., Ltd., is shortly opening an electrical showroom at 97, Queen Victoria Street, London, E.C., but its head office, trade counters, &c., will remain at Lambeth Hill.

Messrs. Price's Electrical Supplies, Ltd., of Birmingham, have been appointed agents for Messrs. Cutting Brothers, of Stamford.

Mr. B. L. Myer, A.M.I.E.E., of Liverpool, has been appointed acting manager of the Liverpool and district depôt of Simplex Conduits, Ltd., at 96, Whitechapel, Liverpool. Telephone No.: "4726 Royal."

Mr. E. P. Bennett, joint sales manager of Simplex Conduits, Ltd., has been given the additional appointment of Colonial sales director for Credenda Conduits Co., Ltd., for the purpose of developing the joint sales policy overseas, following upon the successful initiation of a similar policy for the home market early this year.

Messrs. Isle & Jarrett, electricians, have transferred their business from High Street to larger premises at 28, Haligate, Doncaster.

Mr. R. Ballantine, 101, St. Vincent Street, Glasgow, has been appointed Glasgow agent for wireless voltmeters, by the Walsall Electrical Co., Ltd.

Catalogues and Lists.—The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Catalogues P and XC, giving illustrated details of numerous types of "Exide" and "Clifton" portable accumulator batteries.

Electrical Components, Ltd., 90, Great Charles Street, Snow Hill, Birmingham.—Abridged net price list of electrical accessories, including cables, conduits, switches, fuses, bells, and lighting fittings.

Messrs. Crow, Toogood & Co., 56, High Street, Charing Cross Road, W.C.—Net trade price list of electrical accessories and fittings.

Messrs. C. A. Vandervell & Co., Ltd., Warple Way, Acton Vale, W.—An illustrated and priced folder describing "C. A. V." "all rubber" wireless batteries.

Automotive Clearing House, 175, Oxford Street, W.1.—A brochure containmg details of services and general information regarding automobiles.

Messrs. L. G. Hawkins & Co., Ltd., 116, Charing Cross Road, W.C.2.—Catalogue No. 73, giving full particulars of "Universal" domestic electrical appliances, including cooking ranges, irons, hot-plates, kettles, bowl fires, and numerous other devices.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—"Reasons Why" No. 2, a card advertising the "Economic" bayonet cap lampholder, and No. 3 dealing with cord grips and china interiors of lampholders.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 372, a book of illustrations of rolling mill drives installed by the company.

Superlamp, Ltd., 197, Old Street, E.C.2.—Net trade price list of cables, wires, lampholders, fuses, switches, and other electrical accessories.

Messrs. Justus Eck & S. Brook, 4-12, Palmer Street, Westminster, S.W.1.—An illustrated brochure describing the construction of "Garbe-Lahmeyer" oil-immersed transformers.

Messrs. Pooley & Austin, 34, Broadway, Westminster, S.W.1.—A reprint from *Machinery*, describing the manufacture of Wilson-Wolf fractional h.p. motors, for which the firm holds the Southern agency; also four illustrated leaflets dealing with the same subject.

The Triumph Electric Manufacturing Co., Ltd., Steward Street, Birmingham.—An illustrated price list of "Triumph" electric fans of various types.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—An illustrated and priced folder describing the "Kantark" ironclad distribution board.

The Telegraph Condenser Co., Ltd., Norwich House, Southampton Street, High Holborn, W.C.1.—An illustrated brochure describing "T.C.C." static condensers for power-factor improvement.

Medway's Safety Lift Co., Ltd., 35, Surrey Street, Strand, W.C.2.—A pamphlet giving illustrations of four designs of electric pulley blocks for mounting on steel joists.

Messrs. Joseph Adamson & Co., P.O. Box 4, Hyde, Cheshire.—An illustrated pamphlet containing a description of a one-ton electric pulley block for overhead runways.

Messrs. E. Shipton & Co., 40, King Street, Covent Garden, W.C.2.—A leaflet advertising a 4,000-ohm telephone head-set.

Lead.—Under date August 19th, Messrs. James Forster and Co. report as follows: "The statistica published this week confirm our repeated anticipations of ample supplies. From Australia and Burma alone shipments for July are advised at no less than 11,405 tons—of this Australia is responsible for 8,455 tons, against 5,850 in June and 4,800 in May. Arrivals from Spain last month were 5,616 tons, which is more than double the average monthly arrivals from this source for the previous 10 months, and arrivals from Mexico also increased. The Board of Trade returns for July were:—Imports, 15,059 tons; exports, 2,067 tons, leaving for home absorption 12,992 tons. For the seven months, January-July, imports were 104,069 tons, less exports 22,760 tons, leaving for home absorption 81,299 tons, against 68,368 tons for the same period in 1921. In face of these figures heavy premium for near lead should not exist."

For Sale.—Winchester Corporation Electricity Department has for disposal a quantity of Venner time switches, types "R.B." and "B.F." (See our advertisement columns to-day.)

Book Notices.—"M. & C Machine Mining," August, 1922 (31 pp.) Glasgow: Mavor & Coulson, Ltd.—This number, the first of a new volume, contains articles on "Machine Mining in India," "Electrical Measurements," "Underground Conveying," and notes upon various phases of the use of machinery in mines.

The A. C. R. C. Review, July-September, 1922 (44 pp.). London: Ateliers de Constructions Electriques de Charleroi.—Included in this issue, which is in French, are articles on the application of electricity to rolling mills; centrifugal pumps; electrical machinery and apparatus for mines; the improvement of the power factor of electrical installations by synchronous machines and static condensers; and studies of oiled cloth, &c., insulation.

Year-book and Diary of the Electrical Contractors' Association of Scotland (58 pp. and diary). Glasgow: Hoxton and Walsh (1918), Ltd.—This is practically a directory of electrical contractors in Scotland, as it gives the names, firms, and addresses of the members of the Association's four branches—Glasgow, Edinburgh, Dundee, and Aberdeen. A short history of the Association appears, with a statement of its objects and scope. Other useful information embodied in the Year-book includes:—Particulars of special insurance rates; forms of indenture, and discharge certificates for apprentices; particulars of Scottish electricity supply undertakings; notes on national and district industrial councils; model conditions of tender; rules for contracts; rules for workmen, &c.

Proceedings of the Physical Society of London. Vol. XXXIV, Part 5, August 15th, 1922. London: Fleetway Press, Ltd. Price 6s. net.

Journal of the American Institute of Electrical Engineers, Vol. XLI, No. 8. August, 1922. New York: The Institute. Price $1.

City and Guilds of London Institute.—Department of Technology.—Programme for the Session 1922-1923, containing general regulations and syllabuses for examinations in technological subjects, &c. London: John Murray. Price 3s. 6d. net.

"The Electrical Handling of Materials," by H. H. Broughton. Vol. III. Electric Cranes. Pp. xxi+336, figs. 299. London: Benn Bros., Ltd. Price 50s. net.

Lemberg Industrial Fair.—Organised with the patronage of the Polish Government, and with the support of the municipality of Lwow (Lemberg), chambers of commerce, and big industrials, the second international industrial show is to be held at the city named from September 5th to 15th. The first show, in 1921, was a great success, attracting 500,000 visitors, and realising 28 milliards of marks of sales.

Swedish Trade with Australia.—The *Melbourne Herald* recently asserted that electric motors and other electrical supplies of the heavier class were being imported into Australia from Sweden in considerable quantities, and at prices so far below the quotations for similar goods of British manufacture as to raise a suspicion among representatives of British firms that the Swedish imports were, in part, of undisclosed German origin.

The Swedish Consul in Melbourne (Mr. Waern) informed the journal that every article imported from Sweden must have a certificate of origin from the British Consul to the effect that it is of Swedish manufacture, and he asserted that "A British Consul in Sweden never gives a certificate without satisfying himself personally as to the facts certified to."

To this the *Herald* replied that Mr. Waern's conception of the value of Consular certificates dealing with manufactures was evidently not fully shared by the British firms whose interests were affected in this instance, as formal representations on the subject of the Swedish imports had been made on their behalf to the Customs Department.

South African Electrical Trade.—The *South African Mining and Engineering Journal* for July 20th, states: "The volume of business which was generally expected about this time has failed to materialise. Prices locally remain unchanged, but home quotations are undoubtedly firming up and are likely to advance in the near future. Things in Germany electrically are about 15 per cent. higher than previously, and likely to go higher. People, said a big importer, are biting, but do not seem to get further. Country orders are small compared with inquiries made; everybody seems to imagine that we have not yet come to the end of our troubles. Stocks are very fair, but orders from Britain are not being executed with promptitude. A large importer said he had had an order on hand in England for eight months which had not yet been executed, which confirmed his information that Britain had at the moment her hands full with orders, which the present trouble in Germany was increasing, and still, he said, there was so much unemployment in the Old Country! This important dealer, to illustrate the bad times through which we are passing, stated that an outside mine, which had owed him an account for over twelve months, had, on being pressed at last for a settlement, begged for a further month's respite."

Trade with Samoa.—A United States commercial report shows that during 1921 the United Kingdom supplied 14 per cent. of the imports of Western Samoa, which totalled £408,892; the percentage in 1920 was only 2. Australia and New Zealand together provided 59 per cent. of the total, as compared with 71 per cent. in the previous year. American participation has fallen in the same time from 19 to 18 per cent.

Local Electrical Exhibition.—The E.D.A. informs us that the committee which is arranging the Warrington electrical exhibition has provisionally fixed the week commencing Monday, November 27th, for this exhibition.

Australian Registrations.—The *Melbourne Age* states that Falk, Stadelmann & Co., Ltd., incorporated in London in 1887, authorised capital £650,000, and Welsbach Light Co., of Australasia, Ltd., incorporated in London in 1893, authorised capital £35,000, have been registered in Victoria.

Hydro-Electric Plant Orders.—Since the demand for large-sized water turbines of purely British manufacture induced Messrs. Vickers, Ltd., to take up this class of engineering production in conjunction with one of the leading Swiss hydraulic companies (to ensure that the designs should embody the accumulated experience, extending over many years, of their practice in water-power installations) a number of important contracts have been received. The actual manufacture is carried on at the company's works at Barrow-in-Furness. Recently the New Zealand Government placed with Messrs. Vickers orders for two Pelton turbines, which are now being erected on site, and they followed this up with others for the manufacture of the two Francis turbines, each of 3,100 h.p., for the Hora Hora power station on the Waikato River. These machines, which will operate under a 27-ft. head, are of considerable size, and will give immediate employment to British labour. The technical organisation which Messrs. Vickers have instituted to deal with all hydro-electric matters includes experienced hydraulic engineers, working in close collaboration with the electrical engineering staff of the Metropolitan-Vickers Electrical Co., Ltd., which firm recently obtained the orders for the 6,000-kVA generators and the 100,000-volt switchgear for the Mangahao hydro-electric power station in New Zealand.

Fuller's United Electric Works.—We are informed that a notice is being issued to the unsecured creditors of this company to the effect that consequent upon the trade depression it is necessary to take steps to reorganise the capital. The company has consulted Sir Arthur Whinney, who is engaged on a scheme which will be submitted to a meeting to be held at the earliest possible date. It will be remembered that in 1920 the company made an issue of 200,000 7 per cent. notes in order to provide additional working capital. These notes do not mature until 1925. We are informed that it is hoped that the business, which has a valuable connection, will be kept on foot until the scheme has matured, and to this end the directors are refraining from paying such sums as are due to unsecured creditors so as to prevent anyone obtaining a preference. In the meantime the business is being carried on in order to preserve the goodwill, any necessary supplies being paid for in cash.

Japanese-German Electrical Manufacturing Agreement.—The following particulars are published concerning an agreement reported to have been concluded between the Siemens Schuckert Co. and the Japanese firm Furukawa:—The capital of a new company, to be furnished principally by the Japanese, will be 10 million yen. The factory to be erected with these funds will be ready for operation in two years. The chief electrical articles to be produced will be those which at the present time Japan is obliged to import, namely, telephone apparatus, motors, transformers, measuring instruments, motor vehicles for tramways, electric locomotives, &c. The more delicate articles will be manufactured in Germany and assembled in Japan.—*Reuter's Trade Service* (Berlin).

A Works Visit.—On August 17th, members of the Blackburn Electrical Contractors' Association visited the works of the British Insulated & Helsby Cables, Ltd., performing the journey by motor. The firm provided lunch, and was thanked on the motion of Mr. C. T. Briscoe (chairman), seconded by Mr. J. Walsh (vice-president). Mr. Sprawl responded.

Patent Restoration.—An order has been made restoring Patent No. 121,320 (18,046 of 1917), 1917, granted to Henry Chitty for "Improvements in or relating to commutators for dynamo electric machines."

Boiler Works to be Re-opened.—The works of Messrs. Yarrow & Co., of Glasgow, is being re-opened owing to the development of demand for Yarrow boilers. The works was closed in November last on account of depression in the industry.

Improper Trade Competition in Norway.—A law to combat improper competition was passed by the Norwegian Government on July 7th last. It provides that in the exercise of trade activities or in the service of such activities it is not permissible to undertake for the purposes of competition acts which are improper according to good business custom. No incorrect or misleading statement calculated to convey the impression that a particularly favourable offer is being made for the purchase or sale of goods, or to produce an incorrect impression regarding the business or agreement to which invitation is given, must be made in notices, price lists, circulars, invoices, or other similar business documents, or on goods or their packing. Persons employing such statements can be proceeded against. The exploitation without warrant of technical drawings, descriptions, models, or the like is also prohibited.—*Board of Trade Journal.*

LIGHTING AND POWER NOTES.

Accrington.—Price Revisions.—The Corporation has revised its charges for electricity as follows:—7½ per cent. discount in lieu of 2½ per cent. for lighting and small power users; 5 per cent. to large users, subject to the coal charge restriction; and power supplied for tramway purposes is to be reduced by ¼d. per kWh.

Australia.—Grafton.—A council has been formed of representatives from various governing bodies in the district, with the main object of establishing the proposed Nymboida hydro-electric scheme. The estimated cost of weir, power station, transmission lines, &c., is £80,000. The plant will provide 2,500,000 kWh per annum, and the rate for electricity will be approximately 1½d. per kWh.

Melbourne.—The State Electricity Commission has informed the City Council that it is not willing to renounce the right, acquired by the purchase of a private company, to supply electricity in the Flemington and Essendon district. The Council, in whose area the district is included, has strongly protested against this attitude, holding that the Commission should confine itself to the supply of energy in bulk.

The Morwell Scheme.—It is stated that there is little likelihood of power being obtained from Morwell within a period of eighteen months. In spite of this applications for power are pouring in to the Electricity Commissioners. The scheme will be sufficient to meet all the needs of Melbourne for some time.

The Kiewa Scheme.—The Melbourne *Age* states that the Kiewa scheme has not been abandoned, as rumoured in certain quarters. The Electricity Commissioners are still carrying out surveys and recording flows, &c. Of course, if it is found that power cannot be generated at prices comparable with the cost of energy from other sources it will not be possible to proceed with the development. The *Herald* states that two other schemes which are under consideration, one at Sugar Loaf reservoir, and the other at Seven Creeks, are both superior to the Kiewa scheme.

Blairgowrie (Perthshire).—Proposed Electricity Scheme.—The Town Council is considering an electric lighting scheme for the burgh, and is to procure a report from an expert as to cost of water rights, land, plant, &c.

Bognor.—Price Reductions.—The Bognor Gas-Light and Coke Co. has reduced the price of electricity from the June quarter by 1d. per kWh. Lighting is now charged on a sliding scale down to 9d., and power and heating on a sliding scale down to 3d. per kWh.

Brownhills.—Consent to Supply Refused.—The Urban Council has refused consent to an application by Walsall Town Council for powers to supply electricity to collieries in the Brownhills area. The Council has already given permission to the Cannock Chase Colliery Co., Ltd., to supply electricity in that area.

Canada.—Winnipeg.—The Winnipeg Hydro-electric Department is considering the erection of a steam stand-by plant as an auxiliary to the present hydro-electric generating station. Owing to the requirements of many of the consumers of electric power in Winnipeg for an uninterrupted service, the Department has decided that a steam stand-by plant is necessary. While the interruptions on the transmission line have been very few, still the damage caused by such a storm as that of last May, when both the Winnipeg Electric Railway Co.'s and the city's lines were damaged so as to interrupt the service for some hours, has made it essential that measures be taken to provide for such contingencies. It is proposed to install two 12,500-kVA turbo-generator sets with condensers. The boilers will probably be heated with oil fuel. It is also proposed to install a small electric boiler to keep the fuel feed pipes warm and also to keep one of the turbo sets turning over. Plans and specifications for the equipment are being prepared.—*Electrical News.*

New Generator at Chippawa.—The third of the Hydro-Electric Commission's 60,000-h.p. generators at the new Chippawa plant at Queenston was given its initial run recently without mishap. When the new set commences to deliver electrical energy, the total capacity of the plant will amount to 175,000 h.p. Sir Adam Beck stated that the whole of this output would be sold by the middle of August, and that in view of the possible abnormal demand for power consequent on the coal shortage, work on the fourth and fifth sets would be executed as soon as possible.—*Reuter's Trade Service* (Toronto).

Chobham.—Electricity Supply.—The Woking Electric Supply Co., Ltd., has secured powers to extend its cables to Chobham.

Continental.—France.—The Commercial Counsellor to H.M. Embassy, Paris, writes:—The Minister of Public Works, in a reply published by the *Journal Officiel* to a question put to him by a Deputy, states that the power of the various hydro-electric stations now existing in France may be estimated at 2,100,000 h.p., and that of stations under construction, which will be completed within two years, at 300,000 h.p. The power of the stations in activity at the end of the war amounted to one and a-half million horse power. There has consequently

been an increase since that date of 40 per cent. in the power available. The power now at the disposal of the country is distributed as follows:—Lighting, heating, small motive power, 650,000; industrial motive power, electro-chemistry, electro-metallurgy, 1,300,000; traction, 50,000; agriculture and various, 100,000 h.p.—*Board of Trade Journal.*

Italy.—Construction of a new power plant in the district of Branca, Province of Perugia, is announced by the Italian press. The new plant will utilise the national supply of lignite, and is to be subsidised by the Government for the period set by the decree. The station will be of standardised steam-power type, with a capacity of 15,000 kW, divided into three units of 5,000 kW each, two for regular use and one for reserve. Lignite to the extent of 150,000 tons per year will be used, and there will be by-products amounting to 3,000 tons of ammonium sulphate and 2,550 tons of tar yearly. The subsidy is granted for 20 years, and was fixed at 130 lire per kW installed, a total of 1,950,000 lire. The concession will be accorded the Società Lignitifera Umbra, which already holds the exploitation rights on lignite deposits to be used.—*Commerce Reports.*

Czecho-Slovakia.—From the report for 1921 of the Böhmische Landesbank, it appears that that institution has taken a share in the 30,000,000 kronen 5 per cent. provincial loan for the construction of the Parschnitz generating station, near Trautenau, and in the issue of the 15,000,000 kronen 5 per cent. loan for the building of a hydro-electric station on the Iser River. Furthermore, the bank has taken a share in the issue of a 5 per cent. loan for the construction of the contemplated central station at Reichenberg, which is to be an auxiliary to the Engelsberg station. Altogether 18,200,000 kr. was set aside for electric undertakings in 1921. Up to the end of 1921 the aggregate sum allotted to electrification had totalled 62,259,774 kronen.

The supply of electricity in Southern Bohemia is mainly a question of hydraulic generation. The yearly output of the temporary station at Letoschitz on the Moldau, built by the Provincial Committee, totals six million kWh. In the Wotawa district it is intended to construct two falls near Bergreichenstein and Kieslingbach respectively, with a common high-pressure station, reckoned to yield about 72 million kWh annually. In the Sawa district generating stations are planned at Smrcna, Ledetsch, and Svetla. It is also intended to utilise the water power of the Zelivka and the Sedlitz, while a fall on the Trnavka, near Krelovitz, is yet another scheme. In the Luznitz district the falls are estimated to be capable of yielding 2,500 h.p. The total water power of Southern Bohemia amounts to about 120,000 h.p., of which only 24,000 h.p. is already utilised. With the exception of the hydro-electric station at Holub, all the works hitherto undertaken have been carried out by the Provincial Committee. It is noteworthy also that there exist in Southern Bohemia considerable deposits of turf and lignite coal, which are to be used for a large generating station in contemplation. This is to be linked with the above hydro-electric works by a high-pressure line and will serve as support in the seasons of drought.

Douglas.—Application for Loan.—The Douglas Corporation recently applied to the Tynwald Court for sanction to borrow £62,000 to enable it to proceed with the electricity supply scheme which the Corporation has to carry out within two years. The Attorney-General opposed the application, and urged the postponement of the scheme for five years, his justification being the existing indebtedness of the Corporation. For the latter it was urged that matters had proceeded too far to postpone the scheme, and the inhabitants were expecting a supply of electricity; the undertaking would be on a paying basis in two or three years. An amendment delaying sanction to the loan was lost, and the application granted.

East Ham.—Year's Working.—The annual report (1921-22) of the municipal electricity undertaking (engineer: Mr. W. C. Ullman) records a total revenue of £81,006, an increase of £17,739 upon the previous year's figure. Working expenses decreased by £4,435 to £54,355, leaving a gross profit of £26,651, as compared with £4,477 in the previous year. Capital charges were higher—£12,281, as against £11,480—resulting in a net profit of £14,370, comparing satisfactorily with a deficit of £7,003 in 1921-22. The sales of energy amounted to 5,584,580 kWh, an increase of 519,850 kWh, and the maximum load rose from 2,430 to 2,653 kW. The capital expenditure during the year was £10,451, represented principally by the purchase and installation of cables.

Electricity District.—North-East Midlands.—The Electricity Commissioners—in substitution for the notice they issued on October 12th, 1921—give notice that they will hold a local inquiry in the Town Hall, Sheffield, at 10.30 a.m. on October 17th, 1922, and following days, with reference to the area to be included in the above district and to consider a scheme which has been submitted by the Corporation of Sheffield (Elec. Rev., July 15th, 1921, p. 103) for effecting an improvement of the existing organisation for the supply of electricity in the district and for the formation of a Joint Electricity Authority. The representations and objections which have already been submitted to the Electricity Commissioners in pursuance of the notice issued on October 12th, 1921, will, in the absence of any notification to the contrary from the parties concerned, be duly considered by the Commissioners as if they had been made in pursuance of the present notice.

Emley.—Electricity Supply.—The Yorkshire Electric Power Co., Ltd., in stating that the company has not yet received full powers to supply electricity to the District Council, intimates that it is its intention to make a canvass of the district at an early date.

Glasgow. — Lighting Improvements. — Improved electric lighting is being installed in a section of Maryhill Road as a test in conjunction with the refitting of a part of Alexandria Parade recently completed. It is the intention to augment the lighting of all the main arteries, and a number of central streets have already been dealt with.

Great Yarmouth.—New Plant.—The Corporation has installed new plant at the power station at a cost of £36,000; which was formally set in motion by the Mayor recently. The chief electrical engineer stated that, owing to increased demands, it would be necessary to install a 2,000-h.p. turbo-generator, bringing the output of the undertaking up to 4,000 h.p. The scheme, when completed, will have cost £60,000.

Hayward's Heath.—Overhead Supply System.—Permission to erect overhead wires for the transmission of electricity has been granted, and the installation will shortly be commenced. A generating station is to be erected in the Queen's Road district.

Hitchin.—Extension of Station Sanctioned.—The Electricity Commissioners have given their consent to the extension by the Electric Supply Corporation, Ltd., of the existing generating station at Hitchin by the installation of one 295-kW set.

Holmfirth.—Change of System.—Having received an intimation from the Electricity Commissioners expressing the opinion that immediate steps should be taken to change the existing system of electricity supply for the district, and proposing that the Council should obtain a bulk supply of electricity from the Yorkshire Electric Power Co., Ltd., the Urban District Council has decided to adopt the suggestions.

India. — Hydro-Electric Schemes. — *Indian Engineering* states that the Punjab Government has appointed a Board to discuss hydro-electric schemes in the Punjab. The most important project which will have to be examined, with any improvements and modifications which subsequent surveys may have rendered advisable, will be that prepared some years ago by Sir John Benton at the request of the Maharaja of Patiala. It consists of driving a two-mile tunnel through the ridge which is the axis of the long flat loop of the Sutlej below Bilaspur suspension bridge. Below this tunnel site, at the apex of the loop, is the site for the proposed Bakhra Dam. The Patiala proposal is to pass about 2,000 cusecs of water through the tunnel and back into the river, for generating 100,000 h.p. This is quite independent of the Punjab dam scheme, though any heading up of the water level reaching the tunnel inlet would be of advantage to the Patiala work.

The same journal recently published an article upon the hydro-electric sources of the State of Mysore, with particulars of a number of schemes which have been drawn for their utilisation. Among these is the Bhatkal scheme, which, by the use of three rivers, is expected to provide 40,000 h.p. The Sivasumudrum project already consists of six installations giving a total of 25,000 h.p. The Krishnaraja Sagara scheme is intended primarily to ensure a regular supply of water to the Sivasumudrum scheme, but there are other possibilities if the demand calls for their development. Surveys have been made of two other possible sites—the Shimsha and the Mekedatu Falls. Probably 40,000 h.p. could be provided by the former falls, while the latter are capable of being developed to the extent of about 10,000 h.p. The principal difficulty resides in the methods which must be adopted to maintain the water supply as between the monsoon and dry periods; every scheme requires the construction of a reservoir of large capacity.

Kingston-on-Thames.—Year's Working.—The annual report for the year 1921-22 upon the electricity undertaking (engineer, Mr. T. A. Kingham) records a total revenue of £45,841, as compared with £43,254 in the previous year. Working expenses made a total of £27,128 (£31,199), which, together with £1,750, capital expenditure out of revenue, and £11,916, capital charges deducted from the income, left a net profit of £5,046, as against £697 in 1920-22. The energy sold decreased from 1,928,476 to 1,603,018 kWh. During the year prices were reduced as follows:—Lighting from 1s. to 9d. per kWh; and the surcharge of 20 per cent. on power supplies was reduced to 10 per cent. The capital account shows an expenditure during the year of £7,002.

Leamington.—Electric Lighting Scheme Dropped.—At a recent meeting of the Corporation a scheme of electric lighting to replace the present gas lighting was put forward, but it was finally decided to continue the present system.

Lichfield.—Electricity Supply.—The Rural District Council has decided not to raise any opposition to the proposal of the Cannock Chase Colliery Co., Ltd., to apply to the Electricity Commissioners for a Special Order authorising it to supply electricity in the parishes of Burntwood-Edial-and-Woodhouses, Hammersmith and Ogley Hay, in the area of the Rural Council.

London.—Stepney.—*Year's Working.*—The accounts of the municipal electricity supply undertaking (engineer: Mr. W. C. P. Tapper) for the year ended March 31st, 1922, record a total income from all sources of £257,252, comparing with £229,321 in the previous year. Working expenses were reduced from £175,972 to £168,922, resulting in an increase of gross profit from £53,349 to £88,330. The capital charges were greater, being £60,976, as against £47,487, but the net profit increased from £9,376 to £28,388. The increase in revenue was due to the higher charges instituted during the year, as the sales fell from 28,093,611 to 27,888,661. The prices were reduced again at the beginning of the current year. A total of £215,914 was spent on capital account, the principal items being £129,094 for machinery and £55,320 for mains. It is to be noted that the net profit shown above was subject to a number of charges, including income tax, provision for written-off plant, &c., leaving £3,827 to be transferred to reserve.

Fire.—A fire broke out at the Narrow Street generating station on August 21st, due, it is believed, to the fusing of a connection on the switchboard. The fire was soon extinguished by the fire brigade, but a great part of the district was deprived of light and power for some time.

Westminster.—The Westminster Electric Supply Corporation, Ltd., has arranged that where a water-heating apparatus of the heat storage type is fixed on either the lighting or power circuit, a deduction of 100 kWh per quarter will be made from the total consumption registered by the meter on that circuit for each 50 W of the rated capacity of the water heater. The number of kWh so arrived at will be charged at 1d. per kWh provided that the apparatus is used continuously day and night during the whole of the period and the connections are sealed by the company.

Lydney.—Electricity Scheme.—Preliminary work in connection with the new power station will shortly be commenced. The station, when completed, will have an output of about 30,000 h.p., and will cost, with the transmission lines, &c., nearly £500,000. Electricity will be distributed at 33,000 V to various collieries and industrial undertakings in the Forest of Dean and Stroud Valley. The West Gloucester Electricity Supply Co. is to be formed to carry on the undertaking.

Penybont.—Electricity Supply.—The Council, at a special meeting held recently, decided to apply to the Electricity Commissioners for power to supply electricity to the parishes of Pyle, Kenfig and Tythegstone Higher. Mr. W. Wellbury, manager of the electricity works of the Bridgend Council, who is acting as consulting engineer to the Pennybont Council, stated that if the application were granted it would be possible to give a supply by November. The Council resolved to challenge the Bridgend Council's right to supply electricity to St. Bride's Minor and Newcastle Higher.

Seaford (Sussex).—Proposed Electricity Supply.—The Urban Council on August 14th referred to the General Purposes Committee a proposal to provide electricity for the town.

Southend-on-Sea.—Purchase of Diesel Plant.—The Town Council has applied to the Electricity Commissioners for a loan of £5,000 to cover the cost and installation of a Korting 300-kW Marine type Diesel engine, with pump, accessories, flywheel, &c.

Special Orders.—Confirmations.—The following Special Orders made by the Electricity Commissioners have been confirmed by the Minister of Transport:—Alderley and Wilmslow; Atherstone and District; Edmundson's Electricity Corporation (Dorking and Cromer undertakings); Isle of Wight Electric Light & Power Co.; Lymington (amendment); and Urban Electric Supply Co. (Berwick-upon-Tweed, Redruth, Illogan, Dartmouth, Kingswear, Godalming, and Glossop undertakings).

Taunton.—Price Reductions.—In view of the good results from the past year's working—a net profit of £2,296—the Town Council has approved the following revisions of charges for electricity:—Lighting: Up to 25 kWh per quarter, 10½d. per kWh; 25-500, 7½d.; 500-1,000, 6½d.; above 1,000 kWh, 5d. per kWh; plus 1d. per kWh in the case of "free-wired" installations. Power: Up to 2,000 kWh per quarter, 3½d. per kWh; 2,000-4,000, 2½d.; above 4,000 kWh, 2½d. per kWh. Heating and cooking: Up to 50 kWh, 3½d. per kWh; and above 50 kWh, 1½d.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—At a June meeting of representatives of metropolitan municipal authorities the question of railless traction was discussed. The Tramways Board asked for permission to run trolley 'buses on a number of routes owing to the high cost of rails, and in view of the fact that this system was more economical than petrol traction. The representatives of the City Council said that that body would not oppose the Board's designs, and the general opinion was also in agreement, with certain reservations. The Minister of Public Works said that a proviso would be inserted in the Bill giving the municipal authorities the power to make their own terms with the Board.

Announcements made by the Tramways Board from time to time with regard to its contemplated tramways construction and conversion programme, says the *Argus*, may lead to the belief that immediate operations are intended. Inquiries made of the Board's experts indicate that this is not so. The Board is faced with the expenditure during the next 15 years of £6,200,000 in the conversion of the metropolitan cable system and the construction of new electric lines. The whole of the metropolitan cable system, with the possible exception of the city sections of Collins Street, Bourke Street and Elizabeth Street, it is expected, will be converted to electric traction. The route mileage of electric lines will then probably be as follows: Converted electric lines, 40 miles; present electric lines, 64 miles; Essendon tramway, 11 miles; new routes (at least), 30 miles; total 145 miles.—*Reuter's Trade Service* (Melbourne).

South Australia.—The Melbourne *Age* states that an important meeting of metropolitan local authorities was held at Brisbane in July to consider the formation of the proposed tramway trust, which will administer the tramways of Brisbane when they are acquired by the State Government from the Brisbane Tramways Co. The Government has invited the local authorities to appoint six representatives to comprise the trust, together with two representatives who will be appointed by the Government. One of the two Government nominees will be the chairman. The trust, when formed, is to be asked by the Government to prepare a general scheme for the future development of tramways. Under further provisions of the trust the Government is to advance money necessary for the purchase of the tramways from the Brisbane Tramways Co. This amount is expected to be something like £1,750,000. In addition a sum of £500,000 will be advanced for the renovation of tram cars, extensions of existing lines, their alteration where necessary, and provision of new cars.

Railway Electrification.—The Railway Commissioners of New South Wales anticipate that the electrification of the suburban line between Hurstville and Hyde Park will be completed within three years.

Blackpool.—Traction Supply.—Negotiations are pending between Blackpool and Fleetwood authorities for the latter to supply electricity for the Blackpool-Fleetwood tramways at the Fleetwood end of the route.

Canada.—Winnipeg.—The agreement by which the Winnipeg Electric Railway Co. operates the city's tramways expires in 1927, and the City Council then proposes to take over the system. The company states, however, that it cannot raise the capital necessary to effect improvements with such a short period before expropriation. On the other hand, improvements and extensions are urgently required. An extension of the franchise to 1937 is therefore suggested, when a number of subsidiary systems would also be surrendered. As the City Council would probably have difficulty in raising the necessary funds to carry out the extensions it is considered probable that the request for an extension of tenure will be acceded to.

Cardiff.—Cost of Reconstruction.—According to reports on the cost of electric tramway reconstruction at Cardiff, made by the City Treasurer and City Engineer, a sum of £290,586 was spent from 1915 to March 31st, 1922, on sixteen and a half miles of completed single track, equal to £17,484 per mile, or £9 18s. 9d. per yard. In addition, £34,766 was paid to contractors for special work, making a total of £325,352, of which £9,218 was received from unemployment grants. Wages cost £121,301, material £179,753, and haulage £12,629. In 1914 the costs of reconstruction were £3 12s. 2d. per yard, and in 1921 £12 7s. 7d. At present they are £8 10s. 2d. The use of unemployed men increased them by ten to fifteen per cent.—*Times Trade Supplement.*

China.—Shanghai.—The Shanghai Municipal Council has granted the tramway company permission to establish experimental railless tramway loop services to relieve traffic congestion on Nanking Road and the Bund, the Council reserving the right to revert to present track arrangements. A railless freight service will also be introduced as an experiment. It is stipulated that the company shall pay in connection with rail and railless extensions, in addition to the royalty of 5 per cent. on gross receipts, a sum of $0.02 silver per car-mile, to apply on all car mileage run by the railless freight and passenger services.—*Eastern Engineering.*

Peking.—The Peking Tramways Co. has received the permission of the municipal authorities to proceed with the construction of four trunk lines with a total length of 51.27 li (approximately 20 miles). The company will purchase 60 closed cars, 30 trailer cars, and other rolling stock.

Derby.—Extension of Time.—The Minister of Transport has extended the time until August, 1923, of the Derby Corporation Act, 1913, for the completion of the tramways.

Dewsbury.—Reduction of Fares Urged.—The Trades and Labour Council recently urged the Yorkshire (Woollen District) Electric Tramways Co., in view of the wages reductions now operating amongst the workers in most industries,

to reduce the tramway fares, but the company replied that the fares had not been increased in the same proportion as railway fares or the cost of commodities generally; and that until the general costs fell to a greater degree the fares could not be revised.

East Ham.—Year's Working.—The total income, during the year 1921-22, of the municipal electric tramways (manager: Mr. W. C. Ullman), amounted to £113,250, as compared with £109,586 in the previous year. Operating expenses totalled £111,123, as against £123,912, leaving a gross profit of £2,127, comparing favourably with a gross deficit of £14,326 in 1920-21. Loan interest, sinking fund, &c., absorbed £20,458, causing a net deficit of £18,331. The previous year's net loss was £33,647. The capital expenditure during the year amounted to £13,408, which included equipments for 10 new cars, £7,922. The number of car-miles run decreased slightly—from 1,440,464 to 1,414,954, and the number of passengers carried decreased in greater proportion—from 17,779,901 to 16,689,698.

Glasgow.—Proposed Acquisition of Paisley System.—Under an agreement with the Paisley & District Tramways Co., the Paisley Corporation has the right to supply electricity to the system. The Glasgow Tramways Committee, in arranging for the acquisition of the Paisley tramways, has recognised this right, but states that the price of energy supplied by the Paisley Corporation is in excess of that at which Glasgow could supply electricity. The matter is now the subject of negotiations. On all other points agreement has been reached.

Roller-bearings Experiments.—Experiments are about to be made with roller bearings for tramway cars. It is interesting to note that many years ago trials took place in the city, but at that time roller bearings had not attained the present degree of efficiency, and they were discarded. Should the experiments with the more modern equipment prove satisfactory the matter will be considered by the Corporation Tramways Committee.

Fare Reductions Postponed.—The Tramways Committee decided on August 16th, after considering a report by the general manager, not to make any change in the tramway fares at present.

Leeds.—Coming Fare Reductions.—Despite the unsatisfactory financial position recorded during the past two years, but which is now improving, the Tramways Committee has decided that it is now possible to reduce fares. The Committee has already agreed on reductions which, in general effect, will mean that beyond the first penny stage there will be a reduction of a halfpenny. There is still to be settled the position as to workmen's fares, on which the department has to stand an average loss of some £60 000 per year, and members of the Committee are not decided as to the fairness or otherwise of increasing that loss by reducing the workmen's fares, at the expense of ordinary passengers.

London.—New "Underground" Coaches.—The London Electric Railway Co. is placing contracts for the production of new types of coach for its system. While the manufacturers are bound in certain main essentials, they are being allowed ample latitude for originality and improvement in design. The firms which have secured the contracts are Messrs. Cammell, Laird & Co., Ltd.; the Metropolitan Carriage, Wagon, & Finance Co., Ltd.; the Birmingham Railway Carriage & Wagon Co., Ltd.; the Gloucester Railway Carriage & Wagon Co., Ltd.; and the Leeds Forge Co., Ltd.

Municipal Tramways Association.—Speed Limits.—As a result of representations made by the Association urging the raising of the speed limit for tramcars, the Minister of Transport has consented to consider a revision of existing regulations in this respect in cases where it can be shown that a higher speed limit would be beneficial to the public convenience, and that safe working would be maintained. The limit would be 20 miles per hour, but the Minister states that, having regard to delays caused by other traffic, stopping places, &c., he does not think the present average speed would often be exceeded.

Salford.—Strike Threat.—The employés of the municipal tramways department have threatened to strike if the Corporation carries out its decision to dispense with the trolley boys. They state that in addition to the extra work for the conductors, which this would entail, 130 boys would be thrown out of employment in a time of great difficulty to obtain work.

West Bromwich.—Contemplated Municipalisation of System.—The Town Council has recently had under consideration the question of taking over the tramway system at the expiring of the company's lease in 1924. It has been calculated that the Council could operate the tramways at a small annual profit. Messrs. A. R. Fearnley (Sheffield) and J. B. Hamilton (Leeds), have acted in an advisory capacity.

Wigan.—Reduced Expenditure.—At a recent meeting of the Council, the chairman of the Tramways Committee stated that as a result of re-organisation, and in spite of a reduction in the number of employés, the past year's average rate of car reconstruction had been maintained. A saving of £11,000 had been effected in April, May, and June, as compared with the equivalent period of 1921.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—The Miami Cable.—In connection with the request which has been granted by President Harding for the immediate re-opening of the cable between Miami (Florida) and Barbados for emergency use for transmitting messages to Europe *via* Pernambuco, Brazil has raised an objection to the re-opening of the cable unless it is also used for South American dispatches, to which use the United States has hitherto objected. It is this objection which has hitherto prevented the cable from being employed, and Brazil's refusal to co-operate in the present emergency has upset the arrangements that were made to relieve the transatlantic cable congestion that was caused by events in Ireland.—*Reuter.*

A large amount of Press work has been diverted to the Post Office wireless station at Oxford (Leafield). This station has for some time been conducting a limited Press service to Halifax, Nova Scotia, an average of 2,000 words being transmitted each night, but during the past week about 8,000 words a night have been signalled to Halifax without detriment to the normal services from Oxford, which include a commercial service to Cairo and a long-distance service of ordinary telegrams and news to ships. Oxford has recently commenced the transmission of short Press telegrams to India, where the signals are read direct by the wireless station at Karachi and sent thence to the newspapers in Bombay and Calcutta. During the present emergency the Imperial cable between Penzance and Halifax, Nova Scotia, has also rendered yeoman service. It has been carrying heavy loads in both directions, and has exceeded all its previous traffic records. Efforts have been made to avoid curtailment of the special facilities given by the "*via* Imperial" route for communication with the oversea Dominions. It is the only cable route on which the deferred service at half rates, or less, to Canada, Newfoundland, and the West Indies has been maintained, and it is the only route on which a week-end service at quarter rates is provided to Australia and New Zealand.—*Financial Times.*

Speaking on August 16th as chairman of the Institute of Politics at the Williamstown Round-table Conference on foreign correspondence and international electrical communications, Mr. Walter Rogers, American delegate to the International Communications Conference of 1920, said the interruption of American communication with Europe might be viewed as another proof of the necessity of laying more cables between the U.S. and Europe by way of the Azores. Although the British monopolistic concession at the Azores had expired (he said) Portugal hesitated to grant landing rights to American companies, probably because of the influence brought to bear by the British cable companies. In order to permit a wide extension of American cable contracts every effort should be directed (he urged) to making the Azores easily available for cable relay purposes. They should virtually be internationalised as a cable centre, and Powers obligated by treaties should not, even in war time, seize or control the cables there. While Britain was developing her "all-red" cable system, touching only British soil, it was for Americans to consider what the United States should do in the direction of devising some great constructive American plan of communications.—*Westminster Gazette.*

China.—Automatic Telephone Extensions.—The Shanghai Mutual Telephone Co. has recently ordered 500 automatics to be installed in its East Station, the smallest of the company's plant, as an experiment, but if the project meets with success it is likely that the system will be adopted throughout the city. Dairen has recently installed a 5,000-instrument automatic system and Harbin is now installing a 3,000-instrument system.—*Eastern Engineering.*

New Wireless Station.—We learn from the British Chamber of Commerce *Journal*, Shanghai, that the new wireless station at Liushutun (across the bay to the north of Dairen), the construction of which was commenced last year, was to be opened for public use last month. The total cost has been about £30,000. The installation consists of three steel masts, each 300 ft. high. The method of transmission adopted is that of the Tokio Teishinsho (Department of Communications) and consists of a quenched-spark converter of 7 kilowatts, and an arc converter of 35 kilowatts. By using the latter it is stated that it will be possible to converse direct with Europe and the United States. The power is to be supplied by the new South Manchuria Railway Co.'s power house near Dairen, but as this is not quite ready some of the power is being obtained from Chinchow for the time being.

India.—Automatic Telephones.—In connection with the conversion of the Bombay telephones to the automatic system the Bombay Telephone Co. has placed a contract for the exchange equipment of 11,000 lines, costing approximately £180,000, with the Automatic Telephone Manufacturing Co., Ltd., of Liverpool. The installation is expected to be completed in two years. The contract for the instruments, which will probably amount to another £50,000, has not yet been placed.—*Reuter's Trade Service* (Bombay).

Wireless Telephony.—It is stated in a daily paper that the Marconi Co. is making an application to the Government for liberty to erect a broadcasting station either in Calcutta or in Bombay. The cost of private apparatus ranges from Rs. 150 upwards, and applications for licences are to be forwarded to the Director of Wireless Telegraphy at Simla. The Indian States and Eastern Agency, of Bombay, is arranging to give another demonstration of wireless telephony in Calcutta in October.

Wireless Telegraphy.—Arrangements are being made to improve Colombo's only wireless station at Welikade by adopting the continuous-wave system. The Madras station is to be converted into a high-speed automatic plant for working inland, and the Rangoon station will normally replace the present land lines between Rangoon and Calcutta for traffic between Burma and India. The existing apparatus for communicating with ships is to be replaced by a small station to be erected near St. Thomas Point, which will free the Madras station for inland work.—*Indian Engineering.*

Ireland.—The Telegraph and Telephone Services.—After considerable delay the direct telegraph service between Dublin and Belfast has been restored, and also between Dublin and Limerick. The greater part of South Kerry is still isolated, and likely to be for some time, and all Cork county is isolated. Telephonic communication between Dublin, Belfast, Limerick, Tipperary, Drogheda, and Navan has been restored, but at any moment the service may be interrupted.

Clifden Station Re-captured.—The wireless station at Clifden, County Galway, burned down a few weeks ago by the irregulars of the Irish Republican Army, has been re-captured after a fight of about half-an-hour. The receiver and other portions of essential plant were destroyed by the irregulars and the building partially burned down. It is said that it will take £70,000 to restore the station, which is situated in a wild and desolate part of the country.

Portugal.—Wireless Concession.—The Government has been authorised to contract with the Marconi Wireless Co. for the exclusive right to establish wireless stations in Lisbon, Madeira, the Portuguese African Colonies and the Azores for a period of forty years.—*Financial Times.*

A Portuguese company is to be formed, says the *Financier*, and the fees will be the same as those for submarine cable messages.

Sweden.—West Coast Wireless Station.—The Swedish Telegraph Board has entered into a contract with the Radio Corporation of America for the delivery, at a cost of $432,500, of wireless apparatus for the equipment of the large station that is to be erected on the West Coast of Sweden. The establishment of the station, to which reference was made last week, the maximum cost of which is to be 5,000,000 Swedish crowns, has been approved by Parliament, and the rates will be considerably lower than those at present charged for communication *via* Norway.—*Reuter.*

According to the *Daily Telegraph*, the station will consist of one transmitting station and one receiving station, the former to be built between Varberg and Falkenberg, and the latter near Kungsbacka, both to be finished during 1923.

Wireless Telegraphy.—International Progress.—The progress of international wireless telegraphy is shown by the fact that, since June, 1908, the date of the formation of the Union Radiotélégraphique, the number of shore stations has risen from 76 to 977, and other stations from 246 to 12,622. All the countries of the world are now signatories of the Union Convention save Argentina, Persia, and Turkey. Among the signatories are Czecho-Slovakia and Venezuela (in 1920), Serbia, Croatia and Slovakia (in 1919), the Republics of Ecuador and China (in 1920), and Poland and Dantzig (in 1921). Albania has this year announced its adherence.

Wireless Telephony.—Broadcasting.—The following statement has been issued by the Committee of manufacturers that is at present engaged in creating the Wireless Broadcasting Co.: "The committee has observed that a number of unauthoritative statements have been made with regard to broadcasting, and desires it to be known that until the British Broadcasting Co. is registered, and the board of that company has been appointed, no authoritative statement, in so far as the Broadcasting Co. is concerned, can be made with regard to the future of broadcasting. The memorandum and articles of association of the company are in course of preparation and as soon as they are approved the company will be registered and the Board appointed. Thereafter a full statement will be issued." Mr. Geo. Pells is secretary (*pro tem.*) of the British Broadcasting Co., and the statement was issued from Marconi House, W.C.2.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—December 18th. Victorian Electricity Commissioners. Coal-handling plant for Morwell power station and briquetting works. (See this issue.)

November 4th. Transformers, induction regulators, and switchgear. (August 11th.).

Victorian Electricity Commissioners. January 15th, 1923. Four water-tube boilers, each 4,500 sq. ft., with pumps, piping and structural steelwork for boiler-house.

January 23rd. Back-pressure steam turbine, including a 1,500-kW turbo-alternator.—*Reuter's Trade Service* (Melbourne).

Melbourne.—Victorian Railways. October 11th. Electric storage battery with accessories and spares (Cont. 35,090). October 18th. Motor generator set and static transformer (Cont. 35,089).*

September 20th. Postmaster-General's Department. Switchboard apparatus. October 17th. Automatic c.b. telephone equipment, together with all associated equipment, including apparatus for use at subscribers' premises. (August 18th.)

Victorian Railways. November 29th. Three electric storage-battery industrial trucks capable of carrying 4,000 lb. at five miles an hour.

Ayr.—Works, including wiring for electric lighting, &c., in connection with new wards and other additions at the County Hospital, Ayr. Jas. Kennedy Hunter, 51, Sangate, Ayr.

Belfast. — September 11th. Electricity Department. Stores (including wires, cable, lamps, electrical accessories, &c.) for six months. (See this issue.)

Brighton.—September 18th. Electricity Department. Two water-tube boilers, superheater, economiser, steel chimneys, fans, feed pumps, steam pipes, valves, &c. (August 18th.)

Chile.—September 14th. Chilean State Railways. Electrical plant for the San Rosendo station. Departmento de Materiales y Almacenes, Alameda station, Santiago, Chile. Representation of the Chilean Railways at Paris, M. Bertrand, Boulevard St. Michel 33, Paris.*

Dover.—September 4th. Harbour Board. Electrical sundries for six months. Forms (2s. 6d. each) from Mr. Rutley Mowll, registrar, Castle Street.

Dublin.—September 1st. Post Office Stores Department, Irish Provisional Government. 4,000 ft. (each) casing and covers for wires and cables; 1 ton plumber's solder.

September 15th. 100,000 insulators. (August 18th.)

Edinburgh.—September 5th. Tramways Department. Electrical equipment for 80 electric cars. Manager, Tramways Department.

Egypt.—Cairo.—September 11th. Ministry of Public Works. Installation of switchboard and system of armoured feeders for works of the Palais de Ras el Tine, Alexandria. Chief electrical engineer, Electrical Service, Ministry of Public Works, Cairo.—*Reuter's Trade Service* (Cairo).

Holmfirth. — September 7th. Electricity Department. E.h.p. switchgear, l.p. switchgear, transformers, underground cables, and feeder pillars. (See this issue.)

London.—Metropolitan Asylums Board. August 30th. Electric storage battery at the Grove Fever Hospital, Tooting Grove. (August 11th.)

August 31st. Electric lighting installation at Cornwall House, S.E. (August 18th.)

Islington.—September 20th. Electricity Department. Two water-tube boilers with stokers, draught system, steel chimneys, steam piping, &c.; cooling towers, ponds, pipework, &c. (August 11th.)

Hammersmith.—September 7th. Electricity Department. Transformers, oil-cooled and air-cooled; e.h.p. cables; e.h.p. and h.p. switchgear. (August 18th.)

County of London Electric Supply Co. October 18th. Supply and erection of steam turbo-alternators for the Barking Power Station. (See this issue.)

Edmonton. September 14th. Board of Guardians. Six months' supply of electric lamps. Mr. E. Ridley, clerk, 77, Bridport Road, Edmonton, N.18.

Manchester.—August 31st. Electricity Committee. 420-V ironclad distribution switchgear for auxiliary services. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester.

August 31st. Electricity Committee. Supply and completion of two coal grabs. (Spec. B38.) (August 11th.)

September 9th. Waterworks Committee. One electrically-driven air compressor. (See this issue.)

Merthyr Tydfil.—September 5th. Board of Guardians. Electrical fittings for six months. Mr. F. T. James, clerk, High Street.

New Zealand.—Auckland.—February 1st, 1923. Harbour Board. 22 electric cranes for Princes Wharf.—*Reuter's Trade Service* (Auckland).

Plymouth.—September 12th. Electricity Department. Steam turbine-driven rotary boiler-feed pump.

Salford.—Tramways Department. 250 tons tramway rails. General manager, Corporation Tramways, 32, Blackfriars Street, Salford.

South Africa.—October 18th. High Commissioner. Electrification of the South African railways. Maritzburg-Glencoe power house. Equipment: Coal-handling plant, ash-handling plant, and circulating-water screening plant. Specifications from the Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2.—*Reuter's Trade Service* (Capetown).

Bloemfontein. — September 20th. Municipal Council. 1,200 yd. of 4-core, .2 sq. in., 660-V paper-insulated armoured cable.—*Reuter's Trade Service* (Capetown).

Stockton-on-Tees.—August 31st. District Fund, Gas, and Electricity Committees. Stores, &c., for three months. (August 18th.)

St. Annes-on-Sea.—Electricity Department,. 3,530 yd. .5 x .5 x .25 l.p. 3-core armoured cable; 1,460 yd. 7/22 l.p. ditto; 500 yd. .2 x .2 x .1 l.p. ditto. (August 18th.)

Wakefield.—August 31st. Wiring of Holmfield House for electric lighting. Mr. A. C. Allibone, town clerk, Town Hall, Wakefield.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—The municipal authorities of Genappe have postponed the scheme for the establishment of a central electric lighting station in the town, tenders for which were recently invited.

The firm of Noel, Van Gastol & Mertens, of Brussels, who submitted the lowest tender, have secured the contract for the establishment of a system of electricity distribution in the little town of Bertrix.

Thatcham.—Messrs. Daniel Adamson & Co., Ltd., of Dukinfield, have received an order for one of their latest patent electrically-driven crude sewage lifting plants for Messrs. Cropper's new factory at Thatcham, Berks. Mr. W. C. Easdale, of Westminster, is the consulting engineer to the scheme.

Government Contracts.—The following Government contracts were placed during July, 1922:—

Admiralty (Contract and Purchase Department).

Cables (main and service).—Johnson & Phillips, Ltd.
Telephone Cables.—Johnson & Phillips, Ltd.
Underground Cables.—Johnson & Phillips, Ltd.
Dynamometer.—Heenan & Froude, Ltd.
Dynamos.—Laurence, Scott & Co.
Electro-magnetic Clutch.—Sperry Gyroscope Co., Ltd.
Motors.—General Electric Co., Ltd.
Electric Travellers.—Sir W. Arrol & Co., Ltd.

War Office.

Secondary Battery.—D.P. Battery Co., Ltd.
Recorder Clocks.—Gledhill-Brook Time Recorders, Ltd.
Electric Locomotive and Accessories.—English Electric Co., Ltd.
Incandescent Lighting Fittings (various).—Barton & Sons, Ltd.; Cable Accessories, Ltd.; General Electric Co., Ltd.; W. Kent.

Air Ministry.

Batteries.—Siemens Bros. & Co., Ltd.
Electric Fan Regulators.—Mansell & Ogan, Ltd.

Crown Agents for the Colonies.

Cable.—Hooper's Telegraph & I.R. Works, Ltd.
Lamps, &c.—General Electric Co., Ltd.
Switchgear.—Metropolitan-Vickers Electrical Export Co., Ltd.
Telegraph Apparatus.—Elliott Bros. (London), Ltd.
Train Lighting Spares.—J. Stone & Co., Ltd.
X-ray Apparatus.—Watson & Sons.

Post Office.

Telegraph Apparatus.—Eastern Telegraph Co., Ltd.
Telephone Apparatus.—Automatic Telephone Manufacturing Co., Ltd.; General Electric Co., Ltd. (Peel Conner Telephone Works); Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Testing, Protective Apparatus, &c.—British L.M. Ericsson Manufacturing Co., Ltd.; Evershed & Vignoles, Ltd.; General Electric Co., Ltd. (Peel Conner Telephone Works); Phœnix Telephone & Electrical Works, Ltd.
Battery Boxes.—Siemens Bros. & Co., Ltd.
Telegraph and Telephone Cable.—Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli General Cable Works, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Casing and Cover.—Calder & McDougall, Ltd.
Joint Box Castings.—United Steel Companies, Ltd. (Messrs. T. Butlin and Co. Branch).
Dry Cells.—Ever Ready Co. (Great Britain), Ltd.
Porous Leclanché Cells.—Siemens Bros. & Co., Ltd.
Cords for Telephones.—Phœnix Telephone & Electric Works, Ltd.
C.I. Couplings.—Jones & Attwood, Ltd.
Ducts.—Mountford, Phillips & Co. (1920), Ltd.
Lamps for Switchboards.—A. C. Cossor, Ltd.
Electric Hand Lamps.—Ward & Goldstone, Ltd.
Distribution Cable Plugs.—British Insulated & Helsby Cables, Ltd.
Insulator Spindles.—Bullers, Ltd.
Adhesive Insulating Tape.—Siemens Bros. & Co., Ltd.
Bronze Wire.—R. Johnson & Nephew, Ltd.
Insulated Bronze Wire.—Johnson & Phillips, Ltd.
Copper Wire.—T. Bolton & Sons, Ltd.; Electro-Metals Co;. Enfield Ediswan Cable Works, Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co., Ltd.).
Flame-proof Wire.—Macintosh Cable Co., Ltd.
G. I. Strand Wire.—Shropshire Iron Co., Ltd.
V. I. R. Wire.—W. Geipel & Co.
Leclanché Rod Zincs.—Eyre Smelting Co., Ltd.; Siemens Bros. & Co., Ltd.
Manufacture, Supply, Drawing-in, and Jointing Cable.—(Newport-Pontypool): W. T. Henley's Telegraph Works Co., Ltd.
Telephone Exchange Equipment.—St. Annes-on-Sea.—General Electric Co., Ltd. (Peel Conner Telephone Works); sub-contractors for accumulators, D.P. Battery Co., Ltd.; for motor generator set, Crompton and Co. Minories.—General Electric Co., Ltd. (Peel Conner Telephone Works); sub-contractors for accumulators, D.P. Battery Co., Ltd.; for motor generator set, Crompton & Co.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

In order to enable us to complete replies to queries received this week, we need the names of suppliers or manufacturers of:—

Windowlight electric signs for shop windows.

NOTES.

Standardisation in Australia.—Owing to the absence of any system of standardisation it is contended that there is an enormous waste of money, material and time in Australian engineering industries. In furtherance of a campaign to introduce the principle of standardisation in the industry a deputation representative of several branches of the engineering profession waited upon the Minister of Customs in May last, says the *Melbourne Age*. The Minister expressed his approval of the campaign, and announced that Mr. Knibbs, the Director of the Institute of Science and Industry, would be invited to submit a report, with recommendations, on the whole subject. This would be referred to the Cabinet for action. He considered an all-Australian conference on the question desirable.

Explosion at German Electro Works.—As the result of an explosion at the Rhine electro works at Knapsack three workmen have been killed and several injured.—*Reuter.*

Institute of Marine Engineers.—The report of the Council for the past year shows an increase of membership from 2,355 to 2,629. The list of papers which have been read indicates a very busy session. The re-opening of proceedings takes place on September 2nd, when Engineer Vice-Admiral Sir George G. Goodwin, K.C.B., is to deliver his presidential address.

Educational. — University of London. — A Goldsmid Entrance Scholarship of the value of £90 (£30 a year for three years), tenable in the Faculty of Engineering at University College, London, will be awarded on the results of an examination to be held in the last week of September. Entry forms must be sent in to the Secretary not later than September 9th.

Canadian Cancer Research.—The Quebec Government has decided to set aside $100,000 (about £22,000) for the purpose of establishing a radium institute, under the control of the University of Montreal, for the experimental treatment of cancer.—*The Times.*

Power Supply for the S.E. & C. Railway.—The Electricity Commissioners have issued a statement (which reached us too late to be published this week) with reference to the inquiry, held on May 30th last, into the application of the Managing Committee of the S.E. & C. Railway Co. for consent to establish a generating station at Angerstein's Wharf, at Charlton, and by the West Kent Electricity Co., Ltd., for consent to the establishment of a generating station at Belvedere, Erith.

The Commissioners, while of the opinion that the Railway Co.'s site is suitable for a 60,000-kW station, have considerable doubt whether a station of an ultimate capacity of 150,000 kW can be economically constructed on it. The Railway Co. expects to complete the first stage of electrification of its lines by June 30th, 1925, and the Commissioners have come to the conclusion that it has been proved to their satisfaction that there are authorised undertakers *willing*, and one is *able*, to supply the Railway Co. adequately at no greater cost than would have been incurred by the Railway Co.'s supplying itself. Therefore, it would be no disadvantage to the Railway Co., and would be a gain to the public interests concerned if the Railway Co. were to take its supply from an outside source, and to enable the parties to confer in order that they may arrange a mutually acceptable contract, the Commissioners have postponed their decision for a while.

The statement will be dealt with in more detail in our next issue.

The Applications of Electricity to Poultry Farming.—A paper on the above subject was read by Mr. R. Borlase Matthews at the sixth annual Poultry Conference, held on August 9th, at Harper Adams Agricultural College, Newport, Salop. Out of the large number of papers presented on various matters of importance to commercial poultry farmers, this paper appears to have excited the greatest interest. One of the points which attracted most attention was the electric lighting of poultry houses—a subject which has not received much consideration in this country, though it is almost universal in the poultry farming districts of America. The object is to increase the hours of feeding during the winter months, experience having shown that there is a direct connection between the hours of activity and egg production.

The question of small electricity generating plant for poultry farmers was considered, and the disadvantage of 32-volt and 50-volt circuits was emphasised. The author advocated bare overhead outside mains joined (by special connectors of his own design) to the interior wiring, which should preferably be twin or triple conductors insulated by toughened rubber or similar compound, such as "maconite." To meet the requirements of the farmer a new system of electric light fittings has been developed by Mr. R. Borlase Matthews. The capital outlay for the electrical equipment, a point upon which very little has been written, was dealt with very clearly. The cost was shown to be much less than for oil engines, while the capital expended on equipping a poultry farm electrically will produce an additional return of from 30 per cent. to 50 per cent. per annum—a matter well worth consideration. A demonstration was given of the "Auto-Countancy" system of account keeping, which Mr. R. Borlase Matthews has developed and uses on his own farm.

The conclusion arrived at by the author—and it is amply borne out by the details given in the paper—is that comparatively little capital expenditure is required on the part of any poultry farmer to secure to himself permanent advantage in low labour costs, improved results, and comfortable living—if he spends his money on suitable electrical equipment. Naturally in a development so new to this country competent advice should be sought before making any outlay, but if this is obtained the poultry farmer can proceed with the certainty of increased profits.

The Closing of Londonderry Shipyard.—In view of attacks in the local Press on the conduct of the electricity department of the Corporation of Londonderry, alleging that the shipyard was closed in consequence of excessive charges for electrical energy, the Mayor invited the city electrical engineer, Mr. R. V. Macrory, M.I.E.E., to make a statement to the Council on the subject, which he did on Monday last. Mr. Macrory explained that an agreement had been made (without reference to himself) between the Corporation and the shipyard, which was in operation from November, 1917, to February, 1922; according to this agreement the Corporation undertook to extend the generating plant, provide special cables (costing about £7,000), and supply electricity at special rates, which resulted in average prices ranging from 1.36d. to 1.82d. during the past four years, whilst the load factor never exceeded 26.5 per cent. Being convinced that these charges involved serious loss to the department, Mr. Macrory advised the Corporation to revise them when the agreement expired, and this was done, the new rate, covering the bare cost of production, being under 1.5d. per kWh with a load factor of 20 per cent. and coal at 20s. a ton (less than half the price during recent years). The Shipyard expressed great dissatisfaction with the new terms, and its consulting engineers, Messrs. Sparks and Partners, conferred with Mr. Macrory, who supplied them with all the data asked for.

Councillor Logue, chairman of the electricity department, said the Corporation had lost on an average £5,000 a year for four years under the agreement. The Mayor pointed out that Mr. Sparks had not been able to show that the terms were unfair, and said the Council was resolved not to incur further losses; the Shipyard could install its own generating plant if it thought fit to do so.

In the end the matter was dropped, the view being held that the closing of the shipyard was not the fault of the Corporation. Anyone who knows the present depressed state of the shipbuilding industry will endorse this opinion; the allegation that the yard was closed on account of the excessive cost of power is obviously absurd, for this forms but a small proportion of the working expenses, and the terms offered by Mr. Macrory compare favourably with those prevailing at other industrial centres.

Modern American Street-lighting Practice.—In the paper presented by Mr. Earl A. Anderson at the twenty-seventh annual Convention of the American Society for Municipal Improvements held in Baltimore, Md., some months ago, the types of street-lighting systems most favoured at the present time for lighting the different sections in cities were described. The information contained in this paper shows in effect, therefore, modern street-lighting practice in the U.S.A.

For important business streets in cities, the most widely favoured method of lighting consists in the use of single-light ornamental standards mounted at heights of from 14 to 18 ft. and spaced opposite each other at distances of from 80 to 120 ft. For very narrow streets the lamps may be placed on one side only or staggered at the same spacing. An important increase in efficiency is secured by the use of lamps of 600, 1,000, 1,500 or 2,500 c.p. instead of the three, four or five-light clusters using small lamps which were the vogue before the introduction of the high-powered gasfilled incandescent lamp. There is at present a very noticeable tendency to depart from the use of the opal ball or globe, and to use instead a lantern structure, which by many is considered more pleasing in appearance.

Instead of the single-lamp standards spaced relatively close together, some cities have adopted standards carrying two or even three high-power lamps mounted from 20 to 30 ft. above the street and spaced from 150 to 200 ft. apart. The resultant effective illumination is not greatly different from the more usual arrangement and the exceptionally high mountings minimise any possibility of glare from the lamps. On the other hand, there appears to be much weight on the side of those who contend that in business streets the surrounding brightness of buildings, show windows, &c., is such that there is no possibility of serious glare even with the large lamp at the lower mounting of from 15 to 18 ft., and that the desirable "white way" effect is enhanced by lanterns at these heights spaced from 80 to 90 ft. apart.

The demand for higher levels of illumination in business streets has led in some cities to the consideration of lamp standards carrying two or three 1,000 or 1,500-c.p. lamps each and spaced no more widely apart than previous single-lamp installations. It is quite possible that there will be an increased development of this tendency, especially in the larger cities where the evening business and amusement crowds have become such that in many cities "white way" systems, which were installed largely as an ornamental or advertising feature, are even now barely adequate from the standpoint of lighting safety.

A satisfactory provision for thoroughfares outside the business district is an arrangement of lamps of 600, 1,000, or 1,500 c.p. spaced from 150 to 250 ft. apart, or at a maximum of 300 ft. If the street is very wide it may be necessary to consider each side as a separate street and provide lighting accordingly. The mounting height should be 20 or preferably 25 ft. in order to remove the bright light sources farther from the line of vision, and also in order to obtain a better spread of illumination. In the past, especially where there were wooden pole lines in the streets, it has been common practice to use a lighting fixture suspended from a mast arm. The mast arm has the virtue of bringing the lamp out over the street surface, thereby causing the light rays to clear low hanging foliage of adjacent trees. Bringing the lamp over the pavement also increases the possibilities of seeing objects in silhouette against the bright spot of light beneath the lamp or against the bright streak or glint reflections from the pavement.—A.I.E.E. *Journal*.

Electricity at the North Pole.—The wonders and enjoyment of "listening-in" may be brought to the Esquimaux by Captain Amundsen, who sailed on June 1st from Seattle for the Frozen North, where he will make an aerial survey of the North Pole. For this purpose, an Exide battery of 56 cells has been included among his equipment on the "Maude." This battery is to be used also for radio communication with Washington, and is to furnish electric light during the three years that Captain Amundsen expects to sojourn in the polar regions.

While it will not be possible to get any of the regularly broadcasted concerts for the benefit of his Esquimaux neighbours, Captain Amundsen will be able to put them in touch with the nearest point, which will probably be Nome, Alaska. It is also probable that he may "broadcast" specimens of Esquimaux music which may be picked up by those within 2,000 miles, the radius of his transmitting apparatus.

In addition, Captain Amundsen will keep in touch with Washington four times a day. His radio mesages will be sent and received by relay from Nome to St. Paul Station on the Bering Sea and thence to Washington.

The electric lights which Captain Amundsen will install upon his arrival at his destination will, however, no longer be a novelty for the Esquimaux, who already have been made acquainted with this mode of illumination. In 1914, the Crocker Land Expedition, headed by Captain Donald MacMillan, took a number of Exide batteries, and for the first time in the history of the world the Aurora Borealis had a rival in the form of electric illumination. A few months ago Captain MacMillan returned to the North, and again took an electric lighting system with him.

Captain Amundsen will use aeroplanes upon arriving at the farthest point. From these aeroplanes will be flashed reports to the "Maude," whose powerful transmitting apparatus will relay them back to civilisation.

Such service is necessarily hard on batteries, but Exides have already joined the ranks of Arctic veterans, and nothing short of actual destruction is expected to put them out of commission. The cells taken by the Crocker Land Expedition went through 4,000 miles of storms, and on one occasion were shipwrecked, but never put out of commission.

Reval Industrial Exhibition.—Owing to the success of the Reval Industrial Exhibition this year, the committee of the Exhibition has decided to hold another exhibition next summer. Preparations are being started immediately.—*Reuter* (Reval).

Telephone Progress.—In spite of the vicissitudes through which the British telephone service passed during the war, the arrears of work are being rapidly overtaken and the service is now showing a steady growth. At the end of January last the total number of telephones in the United Kingdom reached the million mark. On April 1st the telephones in Southern Ireland were transferred to the Irish Free State, and thus the Post Office total was reduced by 19,037 telephones; but if the present rate of increase is maintained the Post Office system will comprise over a million telephones by the end of this year.

The Post Office is actively engaged in developing telephonic facilities in rural districts, and, in particular, is drawing the attention of farmers to the value of telephone service in connection with their work. It is estimated that out of 3,110 existing exchanges, 1,930 serve purely rural districts. In addition, the service has been extended in the form of public call offices to 2,250 villages where no exchange exists. Since the beginning of May last 151 rural call offices have been opened. A prominent feature of the urban telephone system is the development of private branch exchange service. There are upwards of 990,000 telephones in the Post Office system; 142,163 provincial stations are joined up to private branch exchanges, and 106,464 London stations are similarly connected.

Automatic exchanges are already working in the following places: Accrington, Blackburn, Chepstow, Darlington, Dudley, Epsom, Grimsby, Fleetwood, Hereford, Hurley (Berks), Leeds, Newport (Mon.), Paisley, Portsmouth, Ramsey (Hunts), and Stockport. The largest of these are Leeds, with 9,600 lines, and Portsmouth, with 5,000 lines. Work is in hand for converting to the automatic principle the exchange systems at Sheffield, Dundee and Broughty Ferry, Gloucester, Gosport, and Brockhurst, Kirkcaldy and Dysart, Shrewsbury, Southampton, Swansea (including Sketty), Torquay, and York, while over thirty other schemes are being developed. In some cases, notably Dundee-Broughty Ferry, Portsmouth-Southampton and Swansea-Sketty, subscribers will use the automatic dialing device for communicating with subscribers on the adjoining exchange in each instance, as well as for calling other subscribers connected with the same exchange as themselves.

Important developments of the trunk wire system are in progress, and £2,230,000 is being spent during the current year under this head. Besides a large extension scheme rapid progress is being made with the work of placing existing routes underground, with the view of securing immunity from damage by storms and for providing for the growth of traffic. The main London-Edinburgh-Glasgow trunk route is being completed by an extension from Leeds to Edinburgh *via* Darlington and Jedburgh, and that from Birmingham to Bristol by the Worcester-Bristol section. Among other important underground routes to be put in hand are the London-Southend, Manchester-Preston, Preston-Lancaster, Colchester-Ipswich, and Edinburgh-Kirkcaldy lines.

For the convenience of users of the trunk lines a system of "fixed time" calls was recently introduced. The arrangement enables subscribers to book calls to be effected at a specified time on payment of a small addition to the ordinary fee.

The Anglo-Continental telephone service has been extended by means of a cable between Aldeburgh and Domburg, and communication with Amsterdam, Rotterdam, The Hague, and other places in Holland is now obtainable. There are at present twelve lines to Paris, three to Brussels, two to Antwerp, and one each to Calais, Lille, and Boulogne. The insertion of telephonic repeaters in trunk lines has greatly extended the range of trunk speech, and if it were practicable to provide additional channels of communication with France and Belgium there is no reason why service should not be extended to Italy, Germany, and other countries. Satisfactory service was, in fact, provided with Genoa during the international conference.

Telegraph Developments.—British progress is in the direction of the wider use of mechanical multiplex systems, by which it is possible to send and receive as many as six telegrams in both directions at one and the same time over a single wire. The first inland installation was fitted to the London-Birmingham route in 1910; in 1914 a second London-Birmingham circuit was arranged, and in the same year the London-Glasgow and London-Liverpool routes were also converted to multiplex working. The system has since been extended to thirty-seven other main routes, and eighteen will be added this year. A three-station multiplex, or what may be termed a "split-multiple," installation, provided in 1920 for the Manchester-Leeds-Newcastle routes, has proved successful, and a considerable number of similar sets will be brought into use within the next two or three years. The outstanding feature of this form of multiplex working is that it is possible to provide mechanical circuits on the less heavily loaded lines, where full quadruplex working is not justified, with considerable decrease in line mileage. For instance, it was formerly necessary to maintain two circuits between Manchester and Newcastle-on-Tyne, two between Manchester and Leeds, and two between Leeds and Newcastle-on-Tyne. The whole of the traffic between these three offices is now disposed of over one line, with Leeds intermediate. Another important feature of this type of multiplex working is that the facilities between the offices on a circuit can be varied where necessary by means of a switch at the intermediate office, to give an additional channel between any two stations.

At the present time about 35 per cent. of the total traffic (some 37,000,000 telegrams per annum) at the Central Telegraph Office, St. Martins-le-Grand, is dealt with by multiplex arrangements, and that figure will be increased to upwards of 50 per cent. when the 1922-23 programme of new installations is completed. It is expected that ultimately 75 per cent. of the traffic at the larger offices will be dealt with by some form of machine telegraph apparatus.

An automatic telegraph concentrator switch is being constructed, and will be tried experimentally. By this system a number of circuits are grouped at one point to facilitate manipulation at periods when the traffic is relatively light, and the circuits are thus brought under observation of the available operators. The use of the switch will simplify the work at the out-stations no less than at the switch office.

It is generally known that the British Government acquired in 1917 a cable to Canada, known as the "Imperial" cable, and its use has considerably improved the communication between the mother country, Canada, and Australasia. The recent purchase of a second cable to Canada places the Post Office in a position to give an excellent service to the Colonies mentioned, as well as to the United States, Central America, the West Indies, and the Northern portion of South America.

Wireless Telegraphy.—On June 20th, 1922, at the Engineering Societies Building, N.Y., before a joint meeting of the Institute of Radio Engineers and the N.Y. section of the A.I.E.E., Senatore Guglielmo Marconi, honorary member of the A.I.E.E., presented a paper on "Radio Telegraphy," which called attention to new developments in the radio field, and Senatore Marconi demonstrated on a miniature set, before the audience of over 1,100 engineers, the possibility of directing wireless waves to any point desired. The Institute of Radio Engineers presented Senatore Marconi with its Medal of Honour, awarded by the Board of Direction to a pioneer of pre-eminent standing in the radio field, whose contributions to the field have added substantially to its development. The author first deals briefly with the early history of long-distance radio communication. The work carried out by the engineers and experts of the Marconi Co. in England with electron tubes or triode valves shows that, according to their experience, greater efficiency can be obtained at present by a number of bulbs used in parallel than by the employment of large single-unit tubes. Information is given in a general way with regard to recent practice in the design and construction of receivers with the object especially of improving selectivity, reducing interference, and concerning the possible speed of working. The lecture also deals briefly with results obtained at receiving observation stations situated in various far distant parts of the world, where it has been ascertained that radio signals arriving from high-power stations situated at or near the antipodes of the observation stations, reach the receivers by various ways around the earth, not always following the shortest great circle route, and also that at such places the electric waves coming round by different ways do in certain cases increase this effect on the receivers whilst in thers interfere with each other. Apparently transmission is easier from west to east than from east to west, and it may be necessary to modify somewhat the transmission formula for long distances. It has also been ascertained that the most troublesome atmospheric disturbances or static usually come from the continents, and not from the oceans. The lecture further deals with a study of short electrical waves, and the results which have been obtained with waves of a length of from 1 to 20 metres, and shows that electric waves of under 20 metres in length, used in connection with suitable reflectors, are quite capable of providing a good and reliable point-to-point, unidirectional system over quite considerable distances. The application of this system as a direction finder in aid of navigation and as a method for preventing collisions at sea, is also dealt with.—A.I.E.E. *Journal.*

Suction Ash Plant at Runcorn.—One of the latest installations of Bennis ash-handling plant has recently been completed at the boiler-house of the Mersey Co.'s generating station at Runcorn, which was described in our pages some time ago, for the disposal of red-hot ashes, as discharged from twelve chain-grate stokers, and delivery by suction pressure to an overhead ash-receiving tank outside the boiler-house. As the ashes fall over the end of the chain grates they drop into small hoppers located beneath the back of the grates, from which they are released periodically into the suction plant by opening a valve. Since it is necessary to break up the ashes to a suitable and uniform size an electrically-operated ash-breaker has been provided, which—being mounted on rails—can be placed between the outlet of any of the afore-mentioned hoppers and the corresponding inlet to the pipe system of the suction plant, which are plumb

above each other. An exhauster of the Root's blower type and a foul-air filter are employed. The exhauster is driven through machine-cut spur gearing by a 110-b.h.p. electric motor. The exhauster is connected to the overhead receiving tank through the intervention of the filter. After the suction main has deposited the ashes in the receiver the foul air is freed from the bulk of the fine dust, which is held in suspension in the foul air in its passage through the filter. The latter consists of a casing in which water sprays meet and purify the air and deposit the impurities in a sludge tank, so that the air passes to the exhauster in a state which does not injure the latter. The contents of the sludge tank are periodically removed, together with the ashes from the receiver, by gravity in railway trucks. A special shute is also provided to alternately deliver the ashes on to the ground or into barrows or small trucks, if this should be desirable. A hand-operated cat-head crane is provided over the top of the receiver to facilitate the renewal of any parts which may be required in course of time. A water service is provided at the inlet to the ash receiver to quench the ashes, and another at the top of the filter. The water is supplied by an electrically-driven centrifugal pump. The supply is automatically controlled by a valve device, designed by Messrs. Bennis, which controls the amount of water according to the volume of ash-laden air passing through the suction mains in such a manner that when but little ash is being carried along the pipes the water supply is checked, and when ash is passing more plentifully the flow of water increases. Several safety devices are also provided for. For instance, a relief valve is located in the pipe line close to the exhauster, which automatically admits air to the latter in the event of any choke in the pipe or of a similar emergency. Other provisions guard against the ill effects caused by explosions, which are always possible with such plant if, through lack of knowledge or inattention, small quantities of unburnt fuel pass into the pipes along with the ashes. When such fuel comes in contact with the red-hot ashes and water in the receiver an explosive gas may be produced, and when this accumulates and ignites considerable damage occurs through explosions. The Runcorn plant is said to be immune from such damage, since sufficient communication is automatically established with the outer atmosphere through the water seal at the bottom of the filter. Also, should an explosion occur, all that could happen would be the automatic opening of the explosion doors and the blowing out of the water from the water seal. In the Bennis type of plant, since the ashes entering the vessel vertically at the top fall direct on to ashes already in the receiver, no wear takes place.

Wireless Developments.—According to the *Daily Mail*, the need for meting out special wave-lengths for different branches of wireless is made clear by a recent expert statement which shows that with the best transmitting or receiving instrument to-day one particular wave-length cannot be isolated; a number of closely allied waves are always transmitted or received. A difference in frequency of at least 10,000 waves a second is necessary for two near-by transmitting stations not to cause interference or "jamming."

Locating thunderstorms by wireless is one of the remarkable operations carried out at the Croydon aerodrome meteorological station. A frame aerial is employed and a wave-length of 30,000 metres; a count is made of the number of atmospherics or static discharges in different directions during a period of 15 seconds. The position of a thunderstorm can be located by finding the direction in which the atmospheric disturbances took place.

A new method of sending photographs by wireless has been recently tried out in Italy, the invention of Prof. Korn. The system depends on the old idea of telegraphing code letters, each representing the size of the successive dots that go to make up a newspaper illustration. Prof. Korn has invented a special form of typewriter for building up the code telegraph into a new picture.

According to the *Daily Express*, a new system for the clarification of wireless messages has been invented by Mr. A. F. R. Cotton and Mr. E. W. Russell, two Cambridge undergraduates. They are able, by the use of artificial crystals, which exhibit a piezo-electric effect, to produce perfect articulation of the human voice and reproduction of all musical sounds, and the inventors of the Cotrus system claim that they can entirely eliminate buzzing. The invention may be adapted to a gramophone.

British Empire Patents.—The report of the conference which was held at the Patent Office, London, in June last, has been issued (H.M. Stationery Office, price 1s. net). The conference was attended by representatives of the self-governing Dominions and India, Mr. W. Temple Franks, C.B., presiding, and ten meetings were held, but no witnesses were called.

The report states that under the existing conditions, in order to obtain patent protection throughout the Empire, at least 46 separate applications have to be made, the initial payments amounting to £287, and the renewal fees to about £1,210. The position is considered by no means satisfactory; in addition to the great expense entailed, there are considerable divergences of practice and procedure, and a lack of certainty that an invention patented in one part of the Empire will necessarily receive the same protection in another.

A resolution of the conference unanimously approving of the institution of a "British Empire Patent" is recorded, and particulars are given of a number of schemes worked out for this purpose, but rejected by the Conference on various grounds. It was decided to recommend a scheme which would preserve in full the existing rights of the United Kingdom, the self-governing Dominions, and India to grant patents within their own borders, but would allow of the establishment of a Central Patent Office for the grant of patents which should extend to any of those areas on registration therein; the scheme would also apply to all the Colonies and Protectorates, and the registration fees would be of such amount as would result in a considerable reduction in the total cost of patents throughout the Empire. One application and one specification would then suffice for the whole Empire, there would be only one examination into novelty, &c., the cost of the procedure—and probably of agents' fees—would be greatly reduced, and the patent would have a greater commercial value owing to the wider search made in the Central Office. Overlapping of functions in the various offices would be reduced, applications would be encouraged, and the system would create a further bond of union between the various parts of the British Empire. By selecting an existing office for the purpose, the cost of establishment would be diminished.

The report states that the Conference held that to undertake a really efficient universal search, such as was "professed to be undertaken by the Patent Offices of Germany and the United States," was impracticable, but that the question might be reconsidered later.

In view of the difficulty of carrying out the foregoing scheme, it was proposed, as a temporary measure, that subject to the right of the Dominions to object before registration of a patent, patents as at present granted by the Patent Office of the United Kingdom should be accepted for registration throughout the Empire, and this provisional scheme was adopted. Outlines of procedure were formulated, according to which, application for registration in a self-governing Dominion or India must be made within one year from the issue of the patent and accompanied by certified copies of the U.K. specification, the privileges, if registration is granted, to date from the date of the patent in the United Kingdom; in the cases of Colonies and Protectorates, application must be made within three years, the registration fee would be £1, and no renewal fees would be payable.

Much importance was attached by the Conference to the provision that certified copies of the specification of the U.K. patent should be accepted as complying with all the provisions of the local law as to lodgment of specifications and as to sufficiency of description and claims, this being regarded as a great step in advance.

The Conference expressed the opinion that it was of the highest importance that the procedure and practice in respect of the grant of patents should be uniform throughout the Empire. In order to guard against non-working, the compulsory licence system was recommended, on the lines of the U.K. Act of 1919. The duration of the Empire patent, it was thought, should be 16 years.

Appointments Vacant.—Constructional engineer (£600), for the Yorkshire Electric Power Co.; teacher in technical electricity, for the Wimbledon Technical Institute; assistant in the sales department (£400), for the Yorkshire Electric Power Co.

Fatalities.—An inquest was held on August 15th into the death of Reginald Hardman, an engineer employed by the British Thomson-Houston Co., Ltd., upon the construction of the Barton, Manchester power station. A witness stated that Hardman and another employé were carrying a steel door weighing about 100 lb. The other man lowered his end and it cut through an electric cable. Both men received a shock at 240 V, but while Hardman was killed the other man escaped death. A verdict of "Accidental death" was returned.

An inquest was held at Sheffield on August 18th upon the body of William Gandy (14) who died from tetanus following upon extensive burns on the left hand, caused by electricity. The mother of the deceased stated that she found her son, on August 5th, lying on his stomach with a toy electric motor clasped in his left hand. A wire from a plug adapter in a lamp socket was attached to the motor, and the current had to be switched off before the boy could be picked up. The burns were dressed, but on August 11th he complained of a sore throat and tightness of the jaws, and the following day he died. Mr. Yerbury, deputy general manager of the Sheffield Electricity Department, who was called to give expert evidence, said that the motor was not designed for a 200-V circuit, and consequently it was burned out when the current was switched on. Witness said that the department had no definite regulation to prevent people connecting apparatus in this way, and he emphasised how dangerous it was for people unacquainted with electrical devices to experiment in this manner. The coroner returned a verdict of "Accidental death."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

The Dundee Corporation Electricity Committee last week considered the appointment of a successor to Mr. Richardson, the manager and engineer to the department. It will be remembered (Elec. Rev., July 21st, p. 96) that Mr. Douglas H. Bishop, who had charge of the generating station at Carolina Port, was recommended for the position at £800, rising by £50 per annum to £1,000, the salary of Mr. Richardson. Mr. Bishop, however, declined to be a candidate for the post unless a commencing salary of £1,000 was guaranteed. It was decided to advertise the appointment at £800, rising to £1,000, though it was pointed out that the basic rate under the Schedule of the Association of Municipal Electrical Engineers, was £1,300. As the result of the advertisement 86 applications were received and a short list of seven was selected (including Mr. Bishop). This was subsequently increased to nine, and last week the committee vote resulted as follows: for Mr. Bishop, 7; for Mr. Lamb (also of Dundee), 5; for Mr. McInnes (of Gravesend), 3. These figures were to be placed before the next meeting of the Council.

On the same day the Dundee Council Wages and Conditions of Service Committee had before it an application from the tramway manager (Mr. W. T. Young) for an increase of salary (at present £600). A proposal by the Lord Provost that an increase to £700 be given was discussed, and an amendment for no increase was moved, but the advance was carried by 6 votes to 5. The *Scotsman* reports that after discussion the Committee unanimously decided to reduce practically all the officials' salaries by one-third of the bonus, it being provided that officials considering themselves aggrieved could make application for adjustment.

On July 10th, at Johannesburg, Mr. D. P. Reid, A.M.I.E.E., M.(S.A.)I.E.E., chief mechanician of the Union Postal Telegraph and Telephone Department, was presented by his colleagues with handsome easy chairs and a teak table on his taking six months' leave prior to his retirement. In making the presentation, Mr. J. E. Williams, divisional plant superintendent, referred to his long acquaintance with Mr. Reid, who had entered the Home service in 1883; since then he had gained experience in the Federated Malay States, Australia, Norway, and Natal, before accepting his present post. Mr. Reid, who is widely known in both technical and musical circles in South Africa, is also interested in agriculture, and is taking up farming in Natal.

Mr. John R. Struthers, assistant resident engineer at the Dalmarnock Generating Station of the Glasgow Corporation Electricity Department, has been appointed chief assistant engineer of the Corporation Electricity Department, Belfast, and takes up his new duties about the middle of September.

Mr. H. W. Wolton, A.M.I.E.E., has joined the board of Mayall & Co., Ltd., electrical and mechanical engineers' merchants, Birmingham.

The *Industrial Australian and Mining Standard* states that Mr. J. E. Schurman, principal technical director of Brown, Boveri & Co., Switzerland, was due to arrive in Australia by the s.s. *Makura* in August. "Mr. Schurman's main object is to inquire into trade possibilities in this country, with special reference to the advisability of manufacturing locally."

Messrs. Wallis-Jones & Dent, consulting engineers (Reginald J. Wallis-Jones, O.B.E., M.Inst.C.E., M.I.E.E.) have removed their office from 23, Old Queen Street, S.W.1, to 50, Queen Anne's Gate, Westminster, S.W.1, (*i.e.*, their pre-war address). Telephone: "8070, Victoria."

Mr. Percy Dunbabin, a member of the staff of the British Insulated and Helsby Cables, Ltd., last week received a case of cutlery from his colleagues on the occasion of his marriage. Mr. George Seddon made the presentation.

At a luncheon held last week Mr. C. E. Town was presented with a massive silver salver and an illuminated address by the representatives of the commercial schools in London on the occasion of his retirement from the assistant secretaryship of the London Chamber of Commerce and the secretaryship of Commercial Education of the Chamber. The presentation was in recognition of the services rendered by him to the cause of commercial education during the past 25 years.

Obituary.—Mr. Francis W. Birkett.—The death took place on August 17th, at the age of 73 years, of Mr. Francis W. Birkett, head of the firm of F. W. Birkett & Sons, Ltd., electrical contractors, brass founders and finishers, at Northgate, Cleckheaton.

Will.—Mr. C. A. Houfton, chairman of the Mansfield Engineering Co., Ltd., mechanical and electrical engineers, left £23,845 gross personalty.

NEW COMPANIES REGISTERED.

Robins Electrical and Wireless Depôt and Institute, Ltd. (183,830).—Private company. Registered August 17th. Capital, £1,000 in £1 shares. To carry on the business of an electrical and wireless depôt and institute, &c. The subscribers (each with one share) are: R. W. Robins, Walbrook, Cyn Coed, Penyland, Cardiff, consulting engineer; Gladys Jones, 31, Morlais Street, Roath Park, Cardiff, clerk. The subscribers are to appoint the first directors. Remuneration as fixed by the company. Solicitors: Phœnix and Levinson, Dumfries Chambers, Dumfries Place, Cardiff.

T. F. Collier & Co., Ltd. (183,805).—Private company. Registered August 16th. Capital, £1,000 in £1 shares. To carry on the business of electrical, mechanical and general engineers, founders, iron and steel workers, &c. The first directors are: T. F. Collier, 352, Manchester Street, Oldham; Mrs. M. A. Collier, 64, Union Street West, Oldham. Qualification: £1. Remuneration (except managing director) as fixed by the company. Registered office: 352, Manchester Street, Oldham.

Unotis, Ltd. (183,835).—Private company. Registered August 17th. Capital, £2,000 in 1,800 preference shares of £1 each and 4,000 ordinary shares of 1s. each. To carry on the business of advertising and general publicity contractors and agents, electrical contractors, sign dealers, dealers in electrical fittings, manufacturers of and dealers in apparatus and appliances, employed by advertising contractors, &c. The subscribers (each with one preference share) are: L. W. Davies, 143, Pearl Street, Cardiff, engineer; G. E. Smith, 221, Gladstone Road, Barry, accountant and auditor. The subscribers are to appoint the first directors. Secretary: G. E. Smith. Registered office: 9, Park Place, Cardiff.

British Radio Sales Co., Ltd. (183,761).—Registered August 15th. Capital, £10,000 in 1s. shares. To carry on the business of mechanical and electrical engineers, manufacturers of and dealers in all apparatus and devices used in connection with telegraphy and telephony, with or without wires, signalling apparatus, &c. The first directors are: Ella M. Kentish, 64, Bishop's Road, Fulham, private secretary; H. Spratt, 43, Margery Park Road, Forest Gate, E., engineer; C. Sommers, 40, Rosewell Road, Shepherd's Bush, W., accountant; A. S. Brereton, Feiden Lodge, Boxmoor, Herts., wireless engineer; J. A. Carter, 11, Bennetts Castle Lane, Chadwell Heath, telephone engineer; J. S. Hogg, 3 and 4, Suffolk Place, Pall Mall, S.W., solicitor; E. L. Chasteauneuf, 32a, Kettering Street, Streatham, S.W., clerk. Remuneration: £150 each per annum (chairman, £200), free of income tax. Registered office: 62, Oxford Street, W.

Radio Service, Ltd. (183,774).—Private company. Registered August 5th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of wireless instruments (complete and otherwise), and accessories, vacuum valves, &c. The first directors are: Wolfie Grossman, 6, Park Crescent, Clissold Park, N.; Mrs. Leah Grossman, 6, Park Crescent, Clissold Park, N. Qualification: 3 shares. Remuneration as fixed by the company. Registered office: Evelyn House, 62, Oxford Street, W.1.

"All British" Wireless Manufactures Co., Ltd. (183,755).—Private company. Registered August 15th. Capital, £500 in £1 shares. To take over the business of wireless apparatus manufacturers and agents carried on by C. Hodgson and K. Lockwood at 70, Central Buildings, 41, North John Street, Liverpool, as the "All British" Wireless Manufactures Co. The permanent directors are: C. Hodgson, 37, Milton Road, Waterloo, Liverpool; K. Lockwood, 103, Breck Road, Anfield, Liverpool. Secretary: L. Jones. Registered office: 70, Central Buildings, 41, North John Street, Liverpool.

Alpha Electric and Oxy Acetylene Welding Co., Ltd. (183,727).—Private company. Registered August 14th. Capital, £2,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are: J. F. Gumm, 30, Romilly Road, Cardiff, clerk; Gladys Jones, 31, Morlais Street, Cardiff, clerk. The subscribers are to appoint the first directors. Remuneration as fixed by the company. Solicitors: Phœnix and Levinson, Dumfries Chambers, 8, Dumfries Place, Cardiff.

Margate and District Electrical Co., Ltd. (183,719).—Private company. Registered August 12th. Capital, £3,000 in £1 shares. To carry on the business of electrical and general engineers, makers of and dealers in apparatus and machinery, &c. The first directors are: T. D. Wood, 1, Ethelbert Terrace, Margate; V. J. Woolls, 63, Cornwall Gardens, Margate, chemist. Qualification: £5. Remuneration as fixed by the company. Secretary: T. D. Wood. Registered office: 262, Northdown Road, Margate.

Excelsior Magnetic and Ignition Co., Ltd. (183,735).—Private company. Registered August 14th. Capital, £1,000 in £1 shares. To carry on the business of engineers, founders, smiths, machinists, manufacturers and patentees of a new type of "commutator" for Ford cars, manufacturers and repairers of all kinds of magnetos and ignition apparatus, electrical machinery, &c. The first directors are: J. Judge, 109, Chapman Street, Oldham Road, Manchester; J. T. Reid, 181, North Road, Clayton, Manchester; J. Valentine, 227, Pendlebury Road, Manchester; H. Shaw, 58, Craven Street, Hightown, Manchester; W. Judge, 109, Chapman Street, Oldham Road, Manchester. Qualification: 75 shares. Secretary: W. Judge. Registered office: 55, Cannon Street, Manchester.

Manchester Radio Co., Ltd. (183,746).—Private company. Registered August 14th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are: F. H. McCrea, 10, Mauldeth Road West, Withington, Manchester, mechanical engineer; J. H. McCrea, 10, Mauldeth Road West, Withington, Manchester, sanitary engineer. F. H. McCrea is first director and chairman. Qualification: £50. Registered office: 155, Oxford Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Eagle Electric Light and Power Co., Ltd.—Particulars of £750, authorised March 31st, 1922, charged on the company's undertaking and property, present and future, including uncalled capital; whole amount issued.

H. Arrowsmith & Co., Ltd.—Debenture dated August 9th, 1922, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: R. C. Haworth, 56, Mosley Street, Manchester.

Hong-Kong Tramway Co., Ltd. (75,486).—Return dated April 27th, 1922 (filed July 27th). Capital, £81,250 in 5s. shares. All shares taken up. £81,250 considered as paid. Mortgages and charges (at date of return), $700,000 (£90,416 13s. 4d. at exchange, 2s. 7d. per dollar)—discharged on June 30th, 1922.

Satisfaction in full on June 30th, 1922, of charge dated May 31st, 1919, and supplemental equitable charge dated May 30th, 1921, securing $700,000.

Sloan Electrical Co., Ltd. (61,528).—Return dated July 5th, 1922. Capital, £60,000 in £1 shares (10,000 preference and 50,000 ordinary). 5,000 preference and 40,000 ordinary shares taken up. £38,500 paid. £6,500 considered as paid. Mortgages and charges, nil.

Rangoon Electric Tramway & Supply Co., Ltd. (86,932).—Return dated May 4th, 1922 (filed June 14th). Capital, £800,000 in 50,000 preference shares of £5 each and 550,000 ordinary shares of £1 each. 50,000 preference and 250,000 ordinary shares taken up. £435,000 paid, being £5 per share on the preference and £1 per share on 185,000 ordinary. £65,000 considered as paid on 65,000 ordinary shares. Mortgages and charges, £231,587.

CITY NOTES.

Indo-European Telegraph Co., Ltd.

The accounts for the year 1921 have now been issued, and they will be submitted for confirmation at the next general meeting. At the meeting held in April last the shareholders were informed of the only salient feature, namely, the expenditure necessary on the reconstruction of the line in Russia and Poland. Mr. C. H. Tritton, son of the chairman, has been elected a director in the place of the late Mr. Chas. Holland. The accounts show a balance carried to profit and loss account of £38,675. To this is added £16,620 brought forward from 1920, and corporation profits tax and income tax amounting to £7,554 are deducted, leaving £47,742. The total dividend of 7 per cent. for the year free of income tax required £29,750, and the balance carried forward is £17,992.

Singapore Electric Tramways Co., Ltd.

The directors announce that, owing to the urgency of the matter, it has not been found practicable to carry out the authority given by the debenture holders at the meeting on July 26th, as it is found that the creation of an effective security, to be given to the Shanghai Electric Construction Co., would involve a serious delay in consequence of the necessity of such security being registered in Singapore. With a view, therefore, to minimising delay and as a precautionary measure, it was decided to apply to the Court forthwith for the appointment of a receiver for the debenture holders, and on August 3rd an order was made appointing Sir William Plender, G.B.E., receiver and manager. Money may be borrowed by the receiver without the necessity of registering a new security in Singapore, and in this way effect will be given, although in a different form, to the course of action sanctioned by the debenture holders.—*Financial Times.*

West India and Panama Telegraph Co., Ltd.

The report for the year to December 31st, 1921, states that the amount to credit of revenue was £93,970, and the expenses totalled £95,490, resulting in a loss on the year's working of £1,519. The debit balance of the revenue account is now £77,911. Had it not been for the fact that £21,991 was earned in 1921 by the hiring of the company's cable ship and by the sale of several years' accumulations of old materials, the total debit balance would have reached nearly £100,000. The hope of improved business in 1921, which the directors entertained, had unfortunately not been realised. Trade in the British West Indies continues stagnant, and there seems little prospect of early revival, and in the American island of Porto Rico, where business is more active, the company has now to meet the competition not only of a French company, but also of an American company. The company's investments having been practically exhausted owing to the long detention of the cable ship at the Trinidad Government dock, the directors recognised that it would not be possible to continue working at a loss, and they considered it imperative to place the serious position of the company before the Treasury and the Colonial Office. The directors pointed out the inconvenience which would result to the British Isles if the telegraph service had to be suspended, and they asked for Government assistance. At present no relief has been offered to the company; there has, indeed, been a definite refusal of direct financial help, but the directors have submitted another proposal, which is now under the consideration of the Government.

French Companies.

The *Ateliers de Constructions Electriques*, of Metz, report a decline in the profits from 405,000 fr. in 1920 to 133,000 fr. last year. Excepting a small sum carried forward, the balance has been devoted to depreciation and reserve fund.

The *Société Francaise Radio-Electrique* reports that the development of the undertaking necessitates the raising of new capital, there being a great disproportion between the latter and the importance of the company. Thus the Levallois works alone has involved an expenditure in excess of the share capital, and the orders executed in 1921 were of the value of nearly five times the amount of the capital. In the circumstances it has been decided to issue 50,000 new shares, and thereby increase the share capital to 12,000,000 fr.

Petters, Ltd.—The report for the year ended March 31st states that after providing for depreciation and bad and doubtful debts, and after the transfer from reserve fund of £25,000 to meet losses on stocks, there is a balance of £10,918. The directors recommend that this balance be carried forward. The financial position does not warrant the payment of any dividend at present.

German Capital Increase.—The Continental Company for Electrical Undertakings, of Nuremberg, has decided to increase the share capital by 2,000,000 marks to 34,000,000 marks by the issue of 6 per cent. preference shares having multiple voting powers. The shares will be taken over by the Schuckert Electricity Company, of Nuremberg, which already holds 75 per cent. of the capital in the other company.

British Columbia Electric Railway Co., Ltd.—Dividends of 3½ per cent., free of income tax, both on the preferred and deferred ordinary stocks, in respect of the year ended June 30th, 1922.

Fairbairn Lawson Combe Barbour, Ltd.—Interim dividend on the preference shares at the rate of 5 per cent. and on the ordinary shares at the rate of 8 per cent. per annum for the six months.

Charles Clifford & Son, Ltd.—Interim dividends for the half-year on the preference shares at the rate of 6 per cent. per annum, less tax, and on the ordinary shares at the rate of 10 per cent. per annum, free of tax.

Stock Exchange Notice.—The undermentioned has been ordered to be officially quoted :—

North Metropolitan Electric Power Supply.—15,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 305,001 to 320,000).

Aberdeen Suburban Tramways Co., Ltd.—Dividend at the rate of 7 per cent. for year, carrying forward £2,027.

Electro Bleach and By-Products, Ltd.—Interim dividend of 3½ per cent., less tax, on the preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The principal activity of the Stock Exchange markets at the present time is that shown in South African mining shares. Outside this particular department, business is quiet, with the War Loan and other similar investment stocks inclined to give way a little owing to the uncertainty of the political developments in connection with Reparations and debt cancellation. For these causes the War Loan has dwindled to the near neighbourhood of 100, but such heaviness has not extended beyond what is called the Consol market. It does not affect, for instance, the strength of industrial debentures and preference issues. The electricity supply list displays all its accustomed firmness. The new County of London ordinary, after being 3s. 9d. premium, eased off to 3s. 3d. premium, which is equal to 25s. 9d. for the fully-paid shares, while the 6 per cent. preference, after touching 2s. premium, are but a few pence less at the present time. Calcutta Tramway Second Debentures have risen to 2¼ premium, though the other Indian Electric new issues are inclined to be dull, Madras being back to the subscription price.

The Home Railway list in the Underground group is distinctly strong. Metropolitan Consolidated took the lead. Rumour links, for the *n*th time in twenty years, the Metropolitan with the Great Western Railway, and the price is up to 54. Districts are good, at close upon 40. Underground Electric ordinary, after touching 2⅜, went back again to 2¼, and the Income Bonds are 1 up at 84¼. For the two recently issued 4½ per cent. Debenture Government-guaranteed stocks of the City and South London and the London Electric companies, demand keeps the price steady at 95¾. In both these cases, buyers can obtain bearer scrip for level amounts of £100 stock. This means that purchasers can escape the heavy 1 per cent. *ad valorem* stamp duty, but, of course, when the stock becomes registered, the stamp will be payable by the buyer.

Some of those interested in electricity supply shares have received copies of the leaflet issued by the "Conference of Local Authorities Owning Electricity Undertakings in London and Home Counties," which leaflet declares that the average selling price from municipal stations is approximately one-third less than the average price charged for supplies from stations that are not municipal stations. Doubtless the informed have means for checking what to the outsider appears a somewhat bold assertion, but obviously the companies are not disturbed by the comparison which is drawn. Westminsters are 5s. better at 7½, and Kensington at 7⅞. Metropolitan ordinary, County ordinary, Chelseas and several preferences are up on the week.

Brush ordinary receded to 25s. 9d., and British Electric Traction, after hardening to 62 went back to 59½. Edison Swan at 3s. 3d. have regained the few pence they lost last week. General Electric ordinary stiffened to 18s. 9d. Metropolitan-Vickers preference at 2½ are 1/16 higher. India Rubber 5 per cent. debentures of 1926 improved to 96. Folkestone Electrics at 3½ are ¼ up, and rises have occurred in Adelaides at 18s. 9d., Urbans 17s. 6d., and a few other shares of this kind. The Eastern Telegraph group has rallied from the slight heaviness which overtook prices last week. Eastern Extensions stand higher at 18⅞, Eastern ordinary at 186½ is 1½ to the good, and Globe preference improved to 11¼. Great Northerns are a little better at 29¼. Anglo-American preferred at 104½ is 1½ up. The West India & Panama Co. publishes another melancholy report, but the price of the ordinary shares remains about 5s.; more or less nominal.

The effect of the chairman's cheerful speech at the Marconi meeting is making itself felt. The parent shares are ¼ better at 2¾. It is said in the market that a good many shares have

recently been pressed for sale and that these have found a home. Moreover, when "broadcasting" begins in earnest the company is expected to benefit substantially from the orders which will pour in for sets ranging from £6 to £50. Radio Common during the last few days have gone up a couple of shillings to 23s. The preferred advanced more quietly, to 14s. 9d., Canadian Marconis are a trifle firmer at 10s. 6d. bid and the Marconi market, as a whole, looks better than it has done for some time past.

Henleys have strengthened to 45s. 9d. Callenders rose to 2½, and this particular group shows marked strength. London and Suburban Traction preference are slightly harder at 10s., the ordinary remaining about 1s. 9d. Babcock & Wilcox eased off to 2¼. The iron and steel market is somewhat heavy, owing to the issue of one or two bad reports during this month.

British Columbia Electric stocks are good, with rises in the preferred and deferred. Mexico Tramways 5 per cent. bonds at 73½ are one higher. Mexican Light & Power fives at 63½ have shed a couple of points. Except for these changes, the foreign list in uninteresting. There is nothing much doing in the rubber market. The price of the material has dwindled below 7d. per lb., but holders of rubber shares are evidently prepared to "see the thing through," and the air is thick with vague talk of certain new developments that are declared to be pending in connection with American demand. These anticipations are too nebulous to provoke any particular buying of shares so long as rubber remains at anything like the present unprofitable level. The armament group of shares is disposed to sympathise with the dulness in the iron and steel division.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Aug. 22. 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7⅝	—	£8 0 0
Charing Cross Ordinary	8	9	7⅜	—	5 17 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6¼	+ ⅛	4 18 0
City of London	14	14	21½	—	6 18 0
do. do. 6 per cent. Pref.	6	6	23/-	+6d.	5 4 4
County of London	8	8	1⅛	+ 1/16	5 11 4
do. do. 6 per cent. Pref.	6	6	23/-	+6d.	5 4 4
Kensington Ordinary	9	10	7⅜	+ ⅛	6 15 7
London Electric	2½	4	2⅛	—	5 11 6
do. do. 6 per cent. Pref.	6	6	5¼	+ ⅛	5 17 1
Metropolitan	7	7	5⅜	+ ⅛	6 4 5
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	8⅞	—	6 17 2
South London	7	7	9¼	—	8 0 0
South Metropolitan Pref.	7	7	1 7/8	—	5 18 0
Westminster Ordinary	10	10	7⅜	+ 1/16	6 11 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	104½	+1½	5 14 8
do. Def.	1½	84/6	23½	—	7 9 0
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8¼	— 1/16	8 9 8
Eastern Extension	10	10	18⅝	+ ⅛	5 6 8
Eastern Tel. Ord.	10	10	186½	+1½	5 7 3
Globe Tel. and T. Ord.	10	10	19½	—	5 3 5
do. do. Pref.	6	6	11⅛	+ ⅛	5 4 4
Great Northern Tel.	24	22	29½	+ ⅛	7 10 6
Indo-European	10	10	26	— 1/16	6 19 0
Marconi	25	15	22⅝	+ ⅛	6 6 4
Oriental Telephone Ord.	12	12	23	—	*5 1 1
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 3
Home Rails.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	54½	+4	4 2 7
do District	Nil	1	89½	—	2 11 6
Underground Electric Ordinary	Nil	Nil	2⅜	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	84½	+1	*4 14 7
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8½	—	7 17 2
do. do. 2nd Pref.	Nil	5½	8⅛	—	7 0 9
do. do. 5 per cent. Deb.	5	5	82	—	6 2 0
Brazil Tractions	Nil	Nil	49½	—	8 1 0
British Columbia Elec. Rly. Pcc.	5	5	76½	—	6 9 9
do. do. Preferred	5	98/-	69⅝	+1	*6 18 6
do. do. Deferred	3	124/-	78½	+2	*8 2 4
do. do. Deb.	4½	4½	76	—	5 11 0
Mexico Trams. 5 per cent. Bonds	Nil	Nil	73½	+1	—
do. do. 6 per cent. Bonds	Nil	Nil	45½	—	Nil
Mexican Light Common	Nil	Nil	22½	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	5	63½	—2	7 17 6
Manufacturing Companies.					
Babcock & Wilcox	15	16	2⅜	— 1/16	5 11 4
British Aluminium Ord.	10	10	18/3	—	—
British Insulated Ord.	15	15	2¼	+ 1/16	7 1 2
Callenders	15	15	2⅛	—	7 1 2
" 6½ Pref.	6½	6½	1 7/8	—	5 9 5
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	3/8	+9d.	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	8 0 0
English Electric	8	5	17/6	—	5 14 8
do. do. Pref.	6	6	18/9	—	6 8 0
Gen. Elec. Pref.	6½	6½	22/-	—	5 18 2
do. Ord.	10	5	18/9	+6d.	5 6 8
Henley	15	15	2 1/16	+ 1/16	6 11 6
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	2⅛	+ 1/16	6 8 0
Siemens Ord.	10	10	27/-	—	*7 8 2
Telegraph Con.	20	20	26	—	*4 12 2

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 23rd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per lb.	7½d.	¼d. dec.
a Ammoniac, Sal ... ... per ton	£63	...
a Ammonia, Muriate (large crystal) "	£48	...
a Bisulphide of Carbon ... ... "	...	...
a Borax ... ... "	£30	...
a Copper Sulphate ... ... "	£26 10s.	...
a Potash, Chlorate ... ... per lb.	5d. to 5½d.	...
a " Perchlorate ... ... "	7¾d.	...
a Shellac ... ... per cwt.	£16 15s.	...
a Sulphur, Sublimed Flowers ... "	£11 10s.	...
a " Lump ... ... "	£11	...
a Soda, Chlorate ... ... per lb.	3½d.	...
a " Crystals ... ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£120	...
b " Wire ... ... per lb.	1/9 to 2/6	...
b " Sheet ... ... "	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£150	...
Grade II ... ... " "	£108	...
Grade III ... ... " "	£62	...
c Brass (rolled metal 2' to 12' basis) per lb.	9¼d.	½d. inc.
c " Tubes (solid drawn) ... "	11⅜d. to 1/-	...
c " Wire, basis ... ... "	10½d.	...
c Copper Tubes (solid drawn) ... "	1/1½	...
c " Bars (best selected) ... per ton	£94	...
c " Sheet ... ... "	£94	...
c " Rod ... ... "	£94	...
d " (Electrolytic) Bars ... "	£71	£1 dec.
d " " Sheets ... "	£145 10s.	...
d " " Wire Rods "	£81	£1 dec.
d " " H.C. Wire per lb.	10½d.	½ dec.
f Ebonite Rod ... ... "	3/6	...
f " Sheet ... ... "	3/-	...
n German Silver Wire ... ... "	2/6	...
h Gutta-percha, fine ... ... "	12/6	...
h India-rubber, Para fine ... ... "	10½d.	1d. inc.
l Iron Pig (Cleveland Warrants) ... per ton	90/-	...
l " Wire, galv. No. 8, P.O. qual. "	£24	£1 dec.
g Lead, English Pig ... ... "	£26	10s. dec.
g Mercury ... ... per bot.	£11 15s.	...
e Mica (in original cases) small ... per lb.	9d. to 3/-	...
e " " medium ... "	4/- to 8/-	...
e " " large ... "	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings "	1/1	...
p " drawn bars and rods "	1/3	...
p " rolled strip & sheet "	1/2½	...
p " wire ... ... "	1/3½	...
o Platinum ... ... per oz.	£19 10s.	...
d Silicium Bronze Wire ... ... per lb.	1/1	...
r Steel, Magnet, in bars ... ... "	1/-	...
n Tin, Block (English) ... ... per ton	£159 10s. to £160	40/- to 50/- dec.
n " Wire, Nos. 1 to 16 ... ... per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r. W. F. Dennis & Co.

Electric Heating Increases Oil Output.—Production from low-gravity oil wells can be increased 100 per cent. through the application of electric heat, says the *Journal of Electricity and Western Industry*. A recent test at one of the Californian oil fields in the case of a low-gravity or "head" well demonstrated the feasibility of the scheme. A 5-kW heater consisting of four sections was placed around the well casing before the pumping commenced. Actual measurement showed an increased production of from 50 to 75 per cent. In the case of a 10-kW heater production was increased 100 per cent. It was determined that the cost of operating such a heater averaged $20 per month per well. Low-gravity or "head" wells can only be pumped approximately eight hours out of twenty-four. The application of the electric heater greatly increased the pumping period. It is believed that there are unlimited possibilities in the application of electric heat to oil production in low-gravity districts, not only in pumping from the wells, but also in transporting the oil from the field to the refinery or to the shipping point.

International Tramway Congress.—The *Electric Railway and Tramway Journal* announces that the first post-war Congress of the Union Internationale de Tramways, de Chemins de Fer d'intérêt local, et de Transports Publics Automobiles is to take place in Brussels from October 2nd to 7th.

Among the subjects which are being discussed are: The type of current for light railways; the use of the mercury vapour rectifier for tramway systems; one-man cars; automatic sub-stations; the repair of tracks by electric welding, &c.; and modern improvements in tramway rolling stock.

FALSE MARKING AND DESCRIPTION OF GOODS WITH SPECIAL REFERENCE TO ORIGIN.

By THEODORE RICH.

Part IV.—A World-Wide Problem.

During the last century England gradually became the leading country of the world regarding the encouragement of business honesty, an important factor being the mercantile law. Steps taken in this country were to a material extent copied in the Dominions and Colonies, and had their reflection in the measures of many other countries.

It was pointed out truly by the 1920 Committee that a British manufacturer cannot protest when he finds that imitations of his goods are being manufactured or sold in some foreign country, and that the local legislation and the practical application of it are inadequate to safeguard his interests, if he lives at home in a glass house where, owing to the state of the law, enormous quantities of goods are sold with impunity with deliberately false marking, "get up," or trade description. It is difficult to expect consuls, diplomats and commercial attachés to take much more than a languid interest in such subjects if people at home refuse to take energetic steps to put their own house in order.

The law in most countries regarding these matters is unsatisfactory and uncertain, and in England exceedingly slow and expensive. In many cases manufacturers hesitate, therefore, to act where their own interests are involved, and only very rarely can be persuaded to move where it is a matter affecting the whole trade.

The alternatives to action by individuals is action by manufacturers' associations, Chambers of Commerce, or by Government departments.

The attitude of the Government always has been that individual concerns, especially if they are of some magnitude, should protect themselves on the assumption that those who pay taxes, and especially those who pay supertax, have no right to expect Government departments to show any direct return for money spent in the way of assistance or actions in law.

Employers who are bothered by overlapping officials whose time is taken up by futile returns, must not expect assistance; the policy adopted regarding the Department of Overseas Trade shows the mentality of the day.

Many Chambers of Commerce are falling under the suspicion of being dominated by alien interests, and too often associations, frightened by the futility and expense of efforts in the past, are slow to act; there are, however, exceptions.

The Case for Government Action.

In the 1890 inquiry the case for Government action was put clearly by Mr. S. G. Richardson, then Master Cutler of Sheffield. *Question*: "In the case of a distinct violation of a trade description, a false description, do you not think that the prosecution should rather be undertaken by the person aggrieved than by the Public Prosecutor?—No, I think not; I think that the Merchandise Marks Act was intended as a benefit to the whole community, and that the expense of prosecuting, and the onus of prosecuting, should fall upon the community."

The same witness admitted that "if the Government undertook the duty and prosecuted, the effect of Government prosecutions would be so striking upon public opinion that there would be a great hesitation before anybody resorted to fraud."

Ever since the original Act was passed there have been continuous demands on the part of a material section of the manufacturers of this country for prosecutions to be undertaken by Government departments. In compliance with these demands, the 1891 short amending Act was passed, which empowered the Board of Trade to act "in cases appearing to the Board to affect the general interests of the country, or of a section of the community, or of a trade" (Section 2).

This amending Act, as far as false descriptions of origin are concerned, has remained almost a dead letter; cases galore have been put before the Board, as blue-book evidence shows. There are more votes and popularity to be got by hauling a manufacturer (the popular Aunt Sally) before a local bench for petty infractions of busybody legislation, and for not paying Trade Board wages that his trade cannot stand, than by prosecuting those who obtain extra profits by "free fraud."

In recent years also, in Government Departments officials have begun to realise that the road to promotion is not facilitated by hostility to the Anglo-German element in our midst and in high places. More than that, knowing the number of men now in Government offices who have only the flimsiest ties to this country, some people are afraid that information they may give may get round much too quickly to rivals in Central Europe and to their agents and allies at home.

If it is right for the Government, by legislation, to protect the worker during his employment, and to safeguard his interest when he pays for his housing, when he buys milk or butter, and to protect the collier by a checkweighman, and the coal consumer from short weight, it is equally just to protect the manufacturer, who risks his capital when providing employment and pays a very high proportion of the local and national taxes, from unfair competition, through non-marking or trade innuendoes, and at the same time to limit the activities of those who rob the ultimate purchaser by making much more profit than they otherwise would but for such deception.

Complaints have been made again and again since 1890 that the Board of Trade keeps no staff of inspectors, no detectives to see that the Act is carried out, to prevent the public being defrauded; although, naturally, money can be found for Labour Exchange officials and continuation-school inspectors, and many thousands of pounds can be voted for almost worthless trade statistics.

The 1894 Merchandise Marks (Prosecutions) Act empowered the Ministry of Agriculture to prosecute in cases relating to agricultural and horticultural produce. Quite apart from prosecutions, complaints by inspectors appointed by this Ministry have led in many cases to the discontinuance of deceptive labels. Traders fear prosecutions and exposure, especially where Government Departments are concerned; the moral effect is very great.

There is little doubt that some of the hundreds of inspectors of both sexes who badger working-class families nowadays could be put on more useful work to promote honest trading.

We have been termed a race of shopkeepers. This country has to stand or fall by its manufacturing and producing stability, not by the least honest section of our merchants and middlemen.

There is, on the other hand, a very strong feeling that if the Government piles burdens in the form of innumerable regulations on to the back of a manufacturer (and while a certain proportion of these benefit the manufacturer in the long run through increased efficiency, yet a material proportion of them, put on as a sop to inspired popular clamour, must react on the minimum price at which he can sell his goods), then it is the duty of the Government to see that a purchaser has reasonable opportunity of judging whether the goods he buys have been made at home under special regulations, or in some country where conditions are better or worse.

As far as trade is concerned, the old principle of our law that "a private injury is a public wrong" is, to a large extent, dead; taxpayers expect more obstruction

than assistance from Government Departments, and fair trade has now become a question not of morality, but of political intrigue.

There is the fear, however, nowadays that if the Board of Trade started to create a department to handle inquiries, a new hotbed of officialdom would result, that four-figure jobs would be handed round in return for political services rendered, and that more time would be spent on form-filling and departmental minutes than in useful work.

There is also the danger that, as with the Business Names Act, respectable people would be harried to create prejudice to the law. Legislation passed to comply with a legitimate demand can quickly be turned into a farce if it happens to be inconvenient to friends of the "powers that be." Years ago, before the days of ultra-professional politics with its appropriate influences, Government Departments were to a large extent trusted by the manufacturing community, as witness remarks in the 1890 Report. Things are different to-day in some cases, it seems.

Board of Trade Inactivity.

The evidence of Mr. H. Fountain, Assistant Secretary of the Board of Trade, before the 1920 Committee, is of considerable interest. He said there had only been a few prosecutions regarding false indications of origin. When a buyer who is not in the trade, and therefore not a specialist, sees a name with an English address on an article he naturally thinks that it is English, but, conveniently for those intending to deceive, the Board of Trade has "felt it impossible to prosecute where a firm in this country simply put their name on goods, unless the firm represent themselves as manufacturers." (Paragraphs 9 and 17.)

There is no obligation on the Customs to notify the Board of Trade when suspicious goods are passed; they often, however, do so. It is exceedingly difficult once goods are in circulation to prove legally that they are foreign and not British, and cases fall at times between two stools.

Mr. Fountain said that his Board had prosecuted in cases where foreign goods have been described in catalogues or advertisements; he did not say whether the words "Works so-and-so," had been used in these cases.

The following questions by Mr. Kerly, K.C., and answers given in the 1920 inquiry by Mr. Fountain, of the Board of Trade, show the mentality of Government Departments. In reply to a question regarding the results obtained, Mr. Fountain said:

"I do argue undoubtedly that the effect of a Board of Trade prosecution is to prevent a large number of other people who were sailing rather close to the wind from doing things which otherwise they would have done, for fear of having a prosecution of that character."

Mr. Kerly, who had had, as he stated, some professional acquaintance with the prosecution of a number of small grocers for selling washing soda as sulphate of soda, said that "after these prosecutions had been going on for a number of years at the expense of Messrs. Brunner Mond, the Board of Trade were persuaded to prosecute themselves, and they secured a conviction. *Answer.*—"I remember such a case."

Mr. Kerly: "After that the misdescriptions continued for years, and the Board of Trade would never prosecute again."

"I suggest to you that the view exists that the Board of Trade has been much too reluctant in plain cases, that it has taken months and months, and sometimes years, to persuade them to move, and that when they have prosecuted they have become so exhausted that it has taken them a long time to recover." *Answer.*—"I do not think I can answer that question."

Firms like Brunner Mond pay many thousands a year in State taxes; they must not expect State officials, whose pay comes from the taxpayer, to stir themselves, except perhaps when the monthly departmental cheque comes to hand; there is then little reluctance and no question of months or years before it is cashed.

Difficulties Regarding the Act.

Ever since the original Merchandise Marks Act was passed, certain glaring defects have been pointed out, and although certain minor amending Acts have been passed, nothing has been done to amend the defective clauses.

One great difficulty is that prosecutions under the Act take place before a Court of Summary Jurisdiction, that is to say, a stipendiary magistrate or local bench, and although the Act allows of an indictment, that is to say, action before a High Court, such facilities have for some reason been rendered nugatory.

It has been pointed out that Merchandise Marks Act cases have to be taken as and when convenient between "drunks" and "black eyes"; the cases sometimes hang on adjourned for months; the celebrated "sardine" case took nearly four years, and when some important point has been thrashed out at endless expense, it carries no material weight, as the proceedings have taken place in an inferior Court.

The case, if the result is disputed, will go to Quarter Sessions, and then perhaps to the High Court.

The case is of a criminal character, and therefore it is often difficult to get sufficient evidence to secure a conviction. "It is extremely difficult, once the goods have got into circulation (that is to say, cleared from the Customs), to prove that they were foreign goods." (1920 Committee, paragraph 19.)

In trade mark cases the matter goes straight to the High Court before a judge who usually has considerable experience in such matters, and therefore the matter goes through more expeditiously; and, further, in all such cases, there is the incentive of a definite injury to a definite party.

Like so many other pieces of legislation, the Act was well meant but badly framed.

An enormous amount of fraud has taken place with the aid of "verbal descriptions"; in a few cases fines have been inflicted; in a number of cases, however, the bench has refused to act. Some people are afraid that the inclusion of verbal misdescriptions might lead to a good deal of perjury, although they apply to the Food and Drugs Act, and those who sail close to the wind are not anxious to put anything in writing.

Those who have wasted a large amount of time and money are loth to spend more in taking a matter to a High Court on appeal, and it is only when the High Court has decided a particular point of law that any point can be said to be definitely decided. The difficulty is not so much the wording of the Act proper as the great inconvenience involved in putting the Act in motion and the dead wall of departmental procrastination and obstruction.

If a manufacturer prosecutes successfully he may get a few guineas costs allowed by the Bench where the actual cost has run into hundreds of pounds, and although under the Act costs allowed are not limited, and in one case in London £500 was allowed, yet as a rule costs are so heavy that even after a successful prosecution a delinquent may be tempted to go on doing the same thing elsewhere, knowing that unless a complaining party is backed by a powerful trade association he will soon get tired of spending money to little effect.

There is also the disadvantage of having trade matters decided by a local Bench, as the Bench may be influenced by personal interests. Merchants and middlemen generally object to the public knowing what they are buying.

A Narrow Escape.—A party of three in a motor-cycle combination narrowly escaped a fatal electric shock on August 16th. While passing through Crayford the side-car passed over a fallen trolley wire, causing a shower of sparks. Tramway workers immediately drew the wire away and the party was unhurt. It is thought that the insulation afforded by the rubber tires prevented a serious accident.

SÖDERBERG ELECTRIC FURNACE ELECTRODES.

Self-Baking Continuous Type.

The Söderberg self-baking electric furnace electrode is a continuous one that is built, baked, and renewed *in situ* on the furnace of which it is a part. It is claimed to be an everlasting electrode which, once installed with the furnace, will continue to work without it being necessary to change it year after year throughout the whole lifetime of the furnace.

The principal way of making the electrode is described by Messrs. C. W. Söderberg and M. Sem, of Det norske Aktieselskab for Elektrokemisk Industri, Christiania, Norway, in *Chemical and Metallurgical Engineering*, from which the following particulars are abstracted. The process is illustrated in fig. 1, from which it will be gathered that the electrode consists of a casing of small-gauge sheet metal (usually iron)) into which ordinary electrode mixture is tamped. The casing serves to give the electrode the right shape while tamping, to reinforce the unbaked part, and to help carry the current from the electrode holder to the baked part of the electrode; it further serves to protect the electrode against air corrosion. In order to give the casing a sufficiently good mechanical and electrical contact with the electrode carbon the casing is provided with ribs extending radially into the electrode. The electrode is suspended in the furnace by means of a clasp holder that can easily be moved along the electrode. The electrode is very long, and its upper part is surrounded by a platform, where the lengthening of

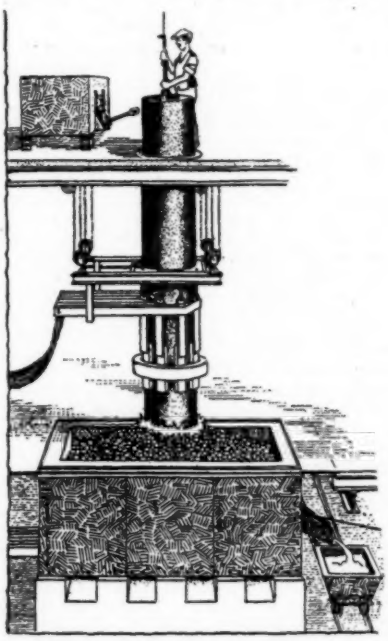

Fig. 1.—Method of Making Söderberg Electrode.

the casing and the tamping in of new electrode mixture may be carried out as often as necessary, without the workmen being exposed to the heat from the furnace. The tamping is usually done by pneumatic rammers.

The lower end of the electrode is placed in the smelting furnace, where it is baked by means of the heat from the furnace crater and by heat developed in the electrode itself by the electric current. The electrode will, therefore, consist of a lower (or internal) fully baked part, and an upper (or external) raw and unbaked part. The electrode holder is ordinarily placed on the lower baked part of the electrode, but may be placed anywhere if the cross-section of the iron casing is sufficient to conduct the current from the holder to the baked part of the electrode. Moving the electrode in the holder is done at full current load, with no interruption in the working of the electrode, the current being always maintained by means of the sliding contact between the electrode holder and the electrode.

When the electrode begins to get too short a new section of iron casing is welded to its upper end and warm electrode mixture is tamped in. The old mixture is still soft, and will mix completely with the new mixture, making the electrode absolutely uniform and with no joints; it will be obvious that the Söderberg electrode has a great advantage over ordinary electrodes in this respect. As in all open furnaces, the electrode holder is water-cooled, and is suspended in a frame that may be moved up and down.

The first Söderberg electrode was used in connection with a ferrosilicon furnace which was put in operation by the A/S Fiskaa Verk per Kristianssand S., Norway, in November, 1918. In July, 1919, it was replaced by a 850-mm. diameter electrode, and this electrode has been working continuously ever since without a single shut down due to the electrode and without any electrode breakage—results which have hitherto been unobtainable. Electrode consumption is considerably reduced, and air corrosion is eliminated to a very great extent, due to the good protection afforded by the iron casing and the electrode holder. The baked electrode is equal in quality to the best ordinary electrodes. The cost of manufacture is relatively very low. In May, 1921, a second electrode (rectangular, 1,150 x 500 mm.) was placed in the furnace (load about 2,000 kVA) and has also worked very well with about the same efficiency and electrode consumption as the round electrode; the furnace operates on three-phase current, Scott-connected.

Important and interesting details in connection with the manufacture and operation of the Söderberg electrode may be found in *Teknisk Ukeblad*, Christiania, 1920, No. 25. See further J. W. Richards, *Trans.*, Am. Electrochem. Soc., 1920, p. 169. The electrode works exactly as an ordinary carbon electrode, and needs no special attention of any kind. It looks like and has the properties of ordinary electrodes, and differs in no way from them either with regard to specific gravity, electrical conductivity, or mechanical strength. The electric resistance of the hot electrodes (1,000 to 2,000 deg. C.) is about 0.003 ohm per cu. cm. It is therefore possible to operate them at a higher current density than ordinary electrodes, and it is further possible to regulate the electrical conductivity to a great extent by the weight of the iron casing in relation to the weight of the baked carbon. In November, 1920, a 400-mm. rectangular electrode was operated continuously at a current density of 10 amp. per sq. cm. At intervals the current load was increased for a short period up to 18 amp. per sq. cm. Due to the good electrical conductivity of the electrode and the short distance from the holder to its lower end, the voltage drop in the electrode is relatively low. At Fiskaa it is ordinarily between 1.3 and 1.9 volts. The heat loss in the cooling water is between 5 and 7 per cent. of the energy consumed in the furnace.

Söderberg electrodes have since been installed in furnaces all over the world. In September, 1920, an installation at A/S. Arendal Smelteverk, Eydehavn, Norway, was put into operation. It consists of two electrodes each 950 mm. in diameter in a two-phase 4,000-kW furnace with two furnace craters running on ferrosilicon (50 and 75 per cent. Si). The electrodes proved to be very much superior to ordinary electrodes with regard to both electrode consumption and furnace output. The consumption of Söderberg electrodes is about one-half that of ordinary electrodes, working on the same alloy in the same furnace. The direct savings obtained are so important that the total cost of the installation will be saved by less than one year's continuous running. While the electrodes in the Arendal plant are 40 per cent. greater in cross-section than the largest ordinary single electrodes, there is no doubt that electrodes of still larger size can be made.

Calcium carbide furnaces are also using Söderberg electrodes with excellent results. The latest installation is in a 6,000-kW. three-phase carbide furnace in the Knapsack plant of the A/G. für Stickstoffdünger at Cologne, Germany. This furnace is provided with three 950-mm. (39-in.) electrodes, and was put into operation in August, 1921. The electrodes are about 7 metres long, and the tamping house (4.5 metres above the platform of the furnace) concrete floor is reinforced by iron tubes for water-cooling. The average results of three months' running show a reduction in the electrode consumption of about one-third. At the same time the output of the furnace per kilowatt-hour was raised considerably. At present the whole plant, consiting of nine furnaces, each rated at about 6,000 kW, is to be provided with Söderberg electrodes, and some of the furnaces are already being rebuilt.

It may be of interest to note that some carbide producers have referred to the fact that part of the iron from the iron casing of the electrode will pass into the carbide and reduce the quality of the product. However, calculation shows that only from 0.1 to 0.2 per cent. of iron can be transferred to the carbide from this source, while ordinary carbide always contains about ten times as much iron. The amount in question is thus of no importance whatever.

Besides the installations described, Söderberg electrodes are at present installed or in course of installation in ferro-alloy and carbide furnaces in Sweden, Italy, France, Germany, and South Africa. Also in closed furnaces the new electrodes have been brought into permanent industrial use. In September, 1920, a 500-mm. (20-in.) Söderberg electrode was installed in a 7-ton Heroult steel furnace of the Stavanger Electro-Staalverk A-S, Jörpeland per Stavanger, Norway, and the results were so good that a permanent installation was

made. In order to get comparative results the electrode was then run together with German electrodes of the best steel-furnace quality and other ordinary electrodes. The 1921 electrode consumption for the Söderberg electrodes was only 58 per cent. of that for the German electrodes used in the same furnace, although the Söderberg electrodes were made of very poor raw materials, so that the ash content was about 15 per cent. The electrodes may be lengthened outside the furnace easily when using small Söderberg electrodes. When using big electrodes, however, it may be more practical to provide a tamping platform which will tilt with the furnace, and which may be removed from the furnace by means of a crane when the roof of the furnace has to be renewed. It may also be possible to arrange the platform fixed to the wall, and constructed in such a way as to permit the electrodes to be tilted with the furnace. Further installations in steel furnaces are at present being made in Germany, and others are under consideration in England, France, and Italy. Another step is the installation of two 700-mm. (29-in.) electrodes in an electric pig-iron furnace of the Elektrometall type in Domnarfvet, Sweden.

It is therefore obvious that the utilisation of Söderberg electrodes shows very great advantages. It is now possible to increase the size of the furnaces without increasing the number of the electrodes. This fact is thought to be of special importance in developing types of closed furnaces for the manufacture of calcium carbide and ferro-alloys

Operating data on Söderberg electrodes indicate the following advantages:—

1. The cost of the electrodes is reduced very much.
2. The cost of special mounting and protecting the electrodes against air corrosion is avoided.
3. The baking is done without cost by waste heat from the furnace crater. (The heat loss through the electrode is, in fact, less than for ordinary carbon electrodes.)
4. The electrode consumption is reduced: (*a*) Because the Söderberg electrodes have no electrode butts. (*b*) Because the air corrosion is very small. (*c*) Because fractures do not occur.
5. The running of the furnace is more regular because there are no stops due to change of electrodes and other troubles experienced with ordinary electrodes.
6. Every individual plant will be independent of electrode factories and will be able to make its own electrodes of the quality and shape most suitable.
7. The number of labourers can generally be reduced and their working conditions are improved, as they are not so much exposed to heat.
8. It is possible to make new furnace constructions, which opens up possibilities for further development of the smelting industry.

The electrodes can be installed in most electric melting and smelting furnaces, and can be built in all shapes and sizes, both round and rectangular. The cost of installation is relatively low—for two electrodes in a 2,000-kW ferrosilicon furnace it would be about $6,000, and the time required would be from one to two months. The cost of electrodes mounted in the furnace and ready for use is estimated at from 2 to 3 c. per lb., including amortisation and interest. This depends upon the prevailing prices of anthracite, coke, tar, pitch, and labour.

The above price is for electrodes of about 34-in. diameter. They may be produced still more cheaply if no anthracite is used in the paste, substituting foundry coke, together with retort carbon or similar material. Such electrodes have been used with very good results in the Fiskaa Verk for several months.

In most open furnaces now with 25 per cent. of electrode butts the electrode consumption will be reduced at least 35 per cent., in which case 10 per cent. of the reduction is due to less air corrosion of the Söderberg electrodes. If ordinary electrodes cost 4 c. per lb. the saving will be as follows:—

Price of ordinary electrodes per 2,000 lb.	$80.00
Cost of mounting and protection against air ...	10.00
	$90.00
500 lb. of electrode butts obtained worth $10 per 2,000 lb.	2.50
Cost of 1,300 lb. electrodes consumed in furnace ...	$87.50
Cost per 2,000 lb. consumed electrodes	$135.00
Cost of 2,000 lb. Söderberg electrodes	40.00
Direct saving	$95.00

To this should be added the indirect savings due to the elimination of electrode changing; less repair on contacts, cables, &c.; more regular running; easier operation of the furnaces; higher output, &c.

In trying to picture the possibilities of development which the new electrode embodies the most prominent is that they are not limited in length or section. Accumulated data all seem to indicate that electrodes are more steady and satisfactory in operation the larger they are. If there are no limits to the size of the electrodes there will be no limits to the size of the furnaces either. When alternating currents are used for smelting there is certainly a limitation to the size of the electrodes, or rather to the number of amperes, owing to the phase-displacement and the skin-effect, which will be quite noticeable at very high current load. Thorough investigations show, however, that when using a 50-cycle current, it is possible to make round electrodes of 1.75-metre (71-in.) diameter, if the current density in the central part is permitted to be 50 per cent. less than at the surface. A 39-in. electrode would show a divergence of 10 per cent. By using 25 or 15-cycle current and allowing a divergence in the current density of 50 per cent. it is possible to make electrodes of 2¾ metres (100 in.), or 3.20 metres (130 in.) respectively. The latter will, at a current density of 3 amp. per sq. cm. (20 amp. per sq. in.) conduct a current of 240,000 amp., which at a voltage of 60, would develop—by means of a single electrode—14,400 kVA.

With this last figure the ultimate limit is not by any means reached. It will be possible to reduce the number of cycles still more, or even to work with direct current. Besides, the electrodes may be given such shapes that the skin-effect will be less, and to meet the requirements of each special process. The electrodes may thus be provided with channels running throughout their whole length, serving, for example, for drawing off the furnace gases or for charging the furnace. The Söderberg electrode may open up a new field of modern electro-thermic industry.

ELECTRIC VEHICLES FOR MUNICIPAL WORK.

A paper was presented at the 49th annual general meeting and Conference of the Institution of Municipal and County Engineers, at Cardiff, in June, by Mr. R. B. Mitchell, M.I.E.E., the engineer and manager of the Glasgow Corporation electricity undertaking, in which is outlined the experience gained in Glasgow with electric vehicles on various municipal services, in the hope that it may help to drive home the fact that battery vehicles can be operated economically, even under very difficult conditions.

The paper explains, *inter alia*, that the road surfaces in Glasgow are mainly cobbled, and there are many stiff hills, so that the conditions cannot be considered favourable for economical working. The nature of the work on which the cars are engaged is very varied, and comprises general cartage for the various sections of the Electricity Department, ash disposal from the power stations, and cable haulage. A tractor is employed for hauling heavy pieces of machinery and cable drums, while a small and speedy three-wheeled van is used for light emergency services.

The diversity of machines and duties has provided very valuable experience on all aspects of electric vehicle running, and it is realised that the scope of the battery vehicle lies in the sphere of action intermediate between that of horse haulage and petrol or steam haulage.

The electric vehicle is used in Glasgow for:—(*a*) General cartage and ash disposal in the Electricity Department (21 machines). (*b*) Refuse collection in Cleansing Department (22 machines). (*c*) Ash disposal in Tramways Department (2 machines). In addition three privately owned machines are garaged in the service station of the electricity department, and four firms have private charging stations. Practically every type of electric vehicle procurable in Britain is represented.

The types of cars used in Glasgow may be divided, roughly, as follows:—American single motor cars with chain transmission, American single motor cars with balanced drive totally enclosed, English single motor cars with chain transmission, and English 2 and 4 motor cars with gear transmission. The early American cars bought in 1912-1915 were exceedingly satisfactory in most respects, the mechanical design, however, left much to be desired. Accordingly, the costs and maintenance of the chassis, brakes, steering gear and body were excessive. The English-built cars, with one or two exceptions, were sound mechanically, but the electrical parts gave an immense amount of trouble as compared with the American machines, the batteries, controllers and motors being all definitely inferior to those of their American rivals. Other English efforts were so bad, both mechanically and electrically, that they must have done an immense amount of harm to the battery vehicle industry generally.

The most important deduction to be made from the author's table of the costs of replacement parts for cars is the enor-

mous preponderance of mechanical replacement costs as compared with electrical ones, even including the battery. The 10 per cent. depreciation claimed as compared with the 15 per cent. in the case of petrol cars, is amply justified.

In the Glasgow Electricity Department the present contract rates for cartage and running costs of electric vehicles are such that one electric vehicle must do the work of three horse vehicles in order to justify its existence. The records of work done by horses operated by contractors show that the best result obtained has been 20 miles per day. The average load in this case was ½ ton. A two-ton electric vehicle has done 47 miles in one day with a load of one ton. This is, however, an exceptional performance, and 40 miles per day would be a fairer basis of comparison. This gives a four to one ratio (40 ton miles to 10 ton miles) in favour of the electric, so that there should be no difficulty in obtaining the three to one ratio which is economically necessary. The nature of the work to be done is all-important in comparisons of this kind, and each case must be examined separately.

Standard battery sizes, as recommended by the vehicle makers, have been used so far, but it has been found that much better results can be obtained by the use of larger capacities. This is particularly the case in winter, when the demand on the batteries is often abnormal. The ampere-hour meters installed on all cars have been fairly satisfactory, but they must be overhauled about once a year. This is rather a serious item on the cost sheet, and it is doubtful whether these instruments will be used on future cars. The best types of car have been available for six days per week for two years on end, and one week is amply sufficient for an overhaul which will enable them to go on for a similar period. It is a much less formidable and costly job to make a complete overhaul of an electrical vehicle than of a petrol or steam car. The best battery result attained in Glasgow has been a total life of three years. The practice of fitting a small battery, and giving it boosting charges, is far from satisfactory in most respects. The question of battery rating deserves close study, and, in the first instance, the author recommends that a guarantee of the number of cycles of charge and discharge should be given in all batteries in addition to the ordinary duration guarantee.

Nickel batteries are practically perfect mechanically, but their high internal resistance, low watt-hour efficiency and voltage are decided disadvantages, especially in hilly towns. The cost of these batteries is also almost prohibitive at present. Lead batteries of the Ironclad Exide type have, in general, given good satisfaction, and their guarantee period of two years can be exceeded very easily in most cases. Flat-plate batteries have not been in use long enough to enable a final pronouncement on their qualities to be made, but there is every possibility that those on trial will prove successful. The figure of 3.45d. per mile for battery renewals cannot readily be reduced, and it lies with the battery makers to devise something more economical.

A good tool equipment is essential for the maintenance of the mechanical parts of the cars. The staff should also get a careful elementary training in the underlying principles of the electric circuit if the best results are to be obtained.

Most of the electrical troubles experienced in Glasgow have been with the multi-motor vehicles. However, recent results with cars of this class have been entirely satisfactory, so that the writer cannot join in the wholesale condemnation of the type which is commonly indulged in. Users should endeavour to find out accurately whether the extra complication of the single-motor type is justified by the higher efficiency claimed for it. The best types of motors are so satisfactory that they require practically no attention. The only improvement which can be looked for in this direction is some very slight increase in efficiency and possibly the introduction of regenerative braking. Combined gear and chain transmission systems have given very good results, but by far the most satisfactory of all has been the balanced drive with one motor and totally enclosed gears.

The only item of the electrical equipment which gives rise to any appreciable trouble is the controller. The plain drum type has proved most satisfactory so far, but there is still scope for improvement, even in the best types covered by Glasgow experience.

The ten years' experience of battery vehicles in Glasgow has included periods in which it seemed wholly impossible to compete with other methods of traction. It is now felt, however, that the worst is definitely past, and that it will be possible to run a wholly electric transport system for the Electricity Department, at least, which will be both reliable and economical.

Those who are contemplating using electric vehicles can rest assured that excellent service can be obtained from them, and the only word of advice offered is the commonplace one: "Settle definitely the best type of car for your own purpose and stick to it."

Discussion.

The paper was not read until the end of the week, and unfortunately Mr. Mitchell was unable to be present to reply to questions raised in the discussion, which was of an interesting character. The President (Mr. E. J. Elford), however, read a letter in which Mr. Mitchell said that, though he could not attend the conference, he would be pleased to supply members with any information they might require on the subject.

Mr. W. J. Steele (Newcastle), opened the discussion, and remarked that in certain districts electric vehicles had proved the best. He had made an experiment extending over six months, but found that when it came to long distances electric vehicles were not so useful, and that steam haulage was slightly cheaper than petrol. He thought all tests based upon so many tons were quite wrong; they should be based upon the cost of the work to be carried out.

Interesting particulars of the comparative costs of electric and horse-drawn vehicles for refuse collection were given by Mr. H. G. Whyatt, whose experience in Grimsby was that they were saving 2s. 7d. per ton by the use of electric vehicles. Their vehicles were bought about 18 months ago, at a costly time, and they cost £1,489 apiece. They had now been in use about fifteen months, and the total cost of collecting by them was 8s. 11¼d. per ton. With horse-haulage it cost them 11s. 6¼d. per ton, whilst by horses which they hired in addition to their own the cost was 6¼d. more. Some members of his Council might think that they had sufficient electric vehicles, whilst others thought they ought to have more for the highways, and additional ones for the household scavenging, but there could be no doubt that for his district the electric vehicle had proved less costly than the horse-drawn one.

Mr. J. A. Dawes (Inspector of Cleansing, Ministry of Health), informed the conference that from data which had come into his possession he found that up to a mile the horse was going quite well at the moment, but on mixed refuse (that was to say, where they were removing from ashpits, as distinct from ashbins) the motor came in earlier. Then, after the mile, the electric vehicle came in, especially in cases where they had what was known as kerb collections. But the further they got away, the heavier the machine, until when they got to three miles he found from the data that steam haulage came into its own.

Mr. Whyatt here interposed the information that an electric vehicle displaced two and a-half horses.

Mr. A. J. Brodie (City Engineer, Liverpool) remarked that there were some people who said that the petrol vehicle was the only vehicle. That was all a mistake, and those people would live to learn differently. He agreed as to its utility over longish distances, but there was still room for the horse in certain districts, for the electric vehicle under certain conditions, and also for the steam vehicle, whilst there was more room for the petrol vehicle if they had a fair distance to go.

In closing the discussion the President pointed out that by putting one vehicle on a long haulage, and another on a short one, with a different kind of refuse, he did not think they could get at a proper basis of comparison. The loading height was a very important question, and he felt that the standard vehicle of many manufacturers was a good deal higher than it need be. They seemed to waste an enormous amount of room.

During the week's conference an exhibition of electrical and other appliances for use in municipal work was held, and the members displayed a keen interest in the various tests.

The Radio-Telephone Fire "Hazard."—The Canadian Dominion Fire Commissioner informs the *Electrical News* that new fire risks have been introduced consequent upon the growth of wireless telephony among amateurs. Fires are caused by lightning, and by the use of lighting circuits in connection with the system. Accordingly, a set of rules has been drawn up to guard against the fire "hazard." Among these regulations is one forbidding the erection of antennæ over any other circuits operating at 600 V or above. Leading-in wires must be of a non-corrosive metal, and in no case smaller than No. 14 B. and S. gauge; these wires must not come within four inches of electric light or power wires unless separated by adequate insulation. Each leading-in wire must be provided with a protective device, which will operate at 500 V or less. Details as to earthing and earthing wires follow the usual lines. Wires inside buildings must not be placed within two inches of lighting or power wires unless separated by insulation, such as porcelain tubing. The Committee which drew up the regulations expressed the opinion that there was no danger of fire in installations employing indoor antennæ.

New German Cable Ship.—According to the *Taegliche Rundschau*, the trial trip of the new German cable steamer *Norderney* took place on August 17th at Wilhelmshaven. The vessel's displacement is about 2,000 tons, her speed 10 knots, and she is capable of carrying 1,100 tons of cable. In addition to wireless, the *Nordeney* is also fitted with submarine signal apparatus. The new vessel seplaces the cable steamer *Grand Duke of Oldenburg*, which was surrendered to the Allies.—*Reuter.*

ELECTRIC LOCOMOTIVES.

By Sir V. L. RAVEN, K.B.E.

(Abstract of paper read at the Institution of Mechanical Engineers' Summer Meeting *at Paris and Liége.)*

The paper does not discuss the many points of mechanical and electrical design of electric locomotives, but deals rather with the more general questions of the requirements which any locomotive must be designed for; the various designs which have been worked out to meet these requirements in the various countries, and the advantages and disadvantages of the various designs which have been completed.

There are broadly three classes into which locomotives on most railways may be divided, namely:—

Shunting Locomotives.—For locomotives of this class a maximum speed of 25 miles per hour will be ample. They should, however, be suitable for moving the heaviest trains in use. On British railways it is not possible to go much higher than 30,000 lb. drawbar pull and an adhesive weight of from 60 to 65 tons should be sufficient. Compared with steam locomotives usually employed in goods-yards this is a substantial increase. The design should be as simple as possible and, if practicable, the whole weight of the locomotive should be on the driving wheels. For anything in the neighbourhood of 60 tons it is necessary to divide the weight between four axles, in order not to exceed the permissible axle loading.

The simplest arrangement is undoubtedly the double bogie design, each bogie carrying a pair of geared motors. This construction is cheap, and the maintenance easy, due to the facility with which a bogie can be removed for overhaul or repair of the motors and a spare bogie substituted. The author sees no reason why this general design should not be regarded as standard for this class of locomotive.

The North-Eastern Railway has had in use on the Quayside line at Newcastle for seventeen years two shunting locomotives which have given extraordinarily good results. Each is capable of hauling 335 tons on the level at 14 m.p.h., and of starting up a gradient of 1 in 25 with a trailing load of 166 tons, and of hauling this load up the same gradient at 9.5 m.p.h. They have only been in the shops three times for thorough overhaul. Their daily service occupies about eighteen hours, and, if required, they could do more. For the whole of the year 1921 the average cost per engine for repairs, inspection, preparing, cleaning, &c., was £103. This figure is rather high, as it included some special repairs to one of the locomotives which would not be required in an ordinary year. The corresponding figure for steam locomotives doing the same class of work for the year 1921 would be about £610.

Freight or Goods Locomotives.—On British railways it is useless to design a locomotive for more than about 30,000 lb. tractive effort. One of the great advantages of electrification on a railway is the possibility it affords of speeding up the slow-moving traffic. When a line reaches the point of congestion the capacity can be increased by quadrupling or by electrification. The former is a very costly matter, and even if the congestion is relieved in this way the many advantages obtainable by electrification are not secured. It is important, therefore, that the speed of goods trains should be raised as much as is practicable. On the British railways, due to the absence of power-brakes on the wagons, the speed on the level must not exceed about 35 miles per hour, and must be less than this on falling gradients, in order that the train may be sufficiently under control to stop when required by signal. The only practicable way, therefore, to effect any substantial increase in the average speed is to increase the speed up the gradients. This can easily be done by providing a sufficiently powerful locomotive and designing it for the speed required.

The author considers that the standard freight locomotive should be capable of taking a normal train up the ruling gradient on any ordinary line in Great Britain at about 25 miles per hour. This should enable an average speed of 30 miles per hour to be maintained, which approximates to the speed of the local passenger trains. All trains, except the few passenger expresses, would then travel at approximately the same speed, and the traffic delays would thereby be cut down to the minimum. The North-Eastern Railway in 1914 built ten freight engines for working the mineral traffic on the Shildon-Newport branch line. Five electric engines are capable of doing the work formerly done by thirteen steam engines. In 1920, which may be considered a fairly normal year, the total cost for repairs, inspection, preparation, cleaning, &c., came to 1½d. per engine mile, of which repairs amounted to a little more than 1d. and shed charges a little less than ½d. Corresponding figures for the same year for steam engines doing similar work are about 11½d. per engine-mile total, of which the repairs alone would cost about 8d., and the shed charges about 3½d. The author estimates that at the present time the corresponding figures for repairs, shed charges, &c., would be about 30 per cent. lower.

Many different designs of electric freight locomotives have been worked out on the Continent and in the U.S.A., but it is not possible to refer to all of them. There seem to be no signs, however, that any standard design of electric freight engine is being evolved as representing the general consensus of opinion of Continental engineers.

In comparing these various designs, the first point to be considered is whether the motors drive directly or through gearing. The cost of the motors alone is something like 30 to 40 per cent. of the total cost of the locomotive. Any design, therefore, which leads to an unnecessarily large and costly motor is at a disadvantage. In the author's opinion the employment of gearing, which is now highly efficient and has a long life, is an essential feature of a satisfactory design. The use of cranks and side-rods for a freight locomotive is not a necessity, either for British railways where comparatively light trains have to be hauled, or in other countries, where the stronger drawgear makes it possible to deal with much heavier trains.

The importance of keeping down the dead weight has been overestimated. The track has to withstand the shocks due to the passage of the whole train, not only of the locomotive, and it is difficult to believe that a little extra dead weight on the four axles of the locomotive alone will make any appreciable difference to the wear and tear of the track.

As to the advantage obtainable by the use of one or two large motors, instead of two or four smaller motors, while it is quite true that, other things being equal, the cost per horse-power falls as the size increases, the difference in favour of the larger motor is more than offset by the extra cost of the mechanical parts. Quite apart from the increase in first cost of the locomotive arising from the introduction of cranks, jack-shafts, Scotch yokes and coupling-rods, the maintenance cost is of great importance. The author is definitely of opinion that for the conditions which apply to British railways, the most suitable and satisfactory arrangement for an electric freight locomotive is the double bogie design with two four-wheel bogies articulated together, each bogie containing two motors geared to the two axles without any form of coupling-rod transmission.

Passenger Locomotives.—While it may be possible to go some way in the direction of standardising the design of locomotives intended for freight-work, it is hardly possible to arrive at any definite conclusion with regard to the best design of locomotive for all sorts of passenger traffic. In the first place the weights of trains vary considerably, as also do the speed and the nature of the line, the gradients, &c. Secondly, when running at high speeds, such as those frequently attained on British railways, a locomotive of unsuitable design may start "nosing," and the oscillations may reach such a degree as to injure the track or the locomotive. There is yet no complete understanding as to the origin of the trouble, or agreement as to the best way of guarding against it.

Regarding the requirements for a standard passenger locomotive for the British railways: (1) Is it necessary that there should be more than one class of locomotive for all kinds of passenger traffic? (2) If one class is sufficient, for what tractive effort and speed should the locomotive be designed, and can it be economically used for goods traffic when necessary?

The answer is to use the same engine for all expresses and fast trains running considerable distances without stopping, including all passenger trains which run beyond the limits of any electrified section, and to equip a sufficient number of trains as multiple unit trains without locomotives for the local passenger service. If this is done, the advantages of electrification can be obtained for both classes of passenger traffic economically and conveniently.

As a reply to the second question, some particulars may be given of the capacity of the geared 4—6—4 passenger locomotive with twin motors and quills which has just been completed by the North-Eastern Railway for experimental purposes.* The conditions specified for the electrical equipment are as follows:—

1. The adhesion weight of the locomotive shall be not less than 17 tons per driving axle, and the complete electrical equipment shall be such that the motors can exert sufficient torque to skid the wheels without injury to themselves or to any part of the equipment.

2. The motors shall be able to exert a total average tractive effort of 16,000 lb. at the tread of the driving-wheels when starting under normal conditions on level track.

3. The capacity of the complete equipment shall be sufficient to enable the locomotive when coupled to a train weighing 450 tons to start from rest on a rising gradient of 1 in 78 and accelerate up to the first economical running speed without injury to any part of the equipment.

4. The speed of the motors and gearing shall not exceed the limits of safety when the locomotive is travelling at 90 miles per hour.

*Elec. Rev., December 30th, 1921, and January 6th, 1922.

5. The locomotive shall be capable of hauling a train of fourteen main-line coaches, weighing, with load, 450 tons, at not less than 65 miles per hour on straight level track.

The electrical equipment consists of three pairs of motors, each having a capacity of 300 h.p., so that the total capacity of the locomotive (one hour rating) is 1,800 h.p., measured at the tread of the wheels. The use of three pairs of motors enables a wide range of speed to be obtained by grouping the six motors—(1) all in series; (2) three in series, two in parallel; (3) two in series, three in parallel. With each grouping provision is made in the control equipment for regulating the speed by reducing the excitation of the motor fields. Thus there are for each grouping four different degrees of excitation, namely: full field, 18, 31 and 40 per cent. reductions. With this arrangement twelve different speeds are available for any particular value of the tractive effort. The performance curves, showing the relation between speed

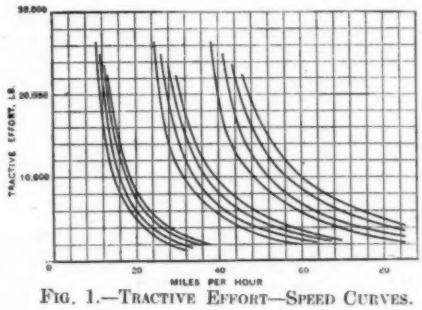

FIG. 1.—TRACTIVE EFFORT—SPEED CURVES.

and tractive effort, as determined by workshop tests, are given in fig. 1. The maximum tractive effort corresponding to a speed of 65 miles per hour is 8,400 lb. or 3¾ tons. The tractive resistance of the locomotive alone at this speed, including that due to windage, should not be more than about 1,600 lb. The drawbar pull would therefore be about 6,800 lb., equivalent to about 15 lb. per ton for a 450-ton train. This should be ample to maintain a speed of 65 miles per hour on the level under any ordinary conditions of weather. A tractive effort of from 8,000 to 10,000 lb. can be obtained at a speed of from 31 to 34 miles per hour. Allowing, say, 900 lb. for the tractive resistance of the locomotive alone, the drawbar pull available at a speed suitable for goods train working is about 7,000 or 9,000 lb. This should be quite sufficient for a train of 600 tons. The speed of such a train up a 1 in 100 gradient would be about 24 miles per hour, which corresponds closely to the conditions of opera-

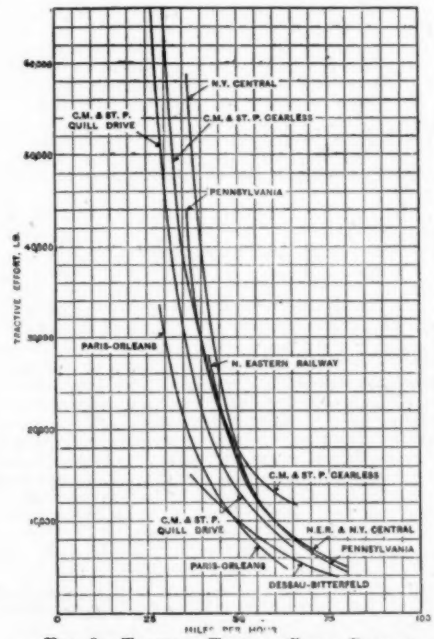

FIG. 2.—TRACTIVE EFFORT—SPEED CURVES.

tion already advocated in connection with the design of a standard freight locomotive. A goods train of 600 tons is a reasonable load for a return trip of a passenger engine on a section in which the ruling gradient is about 1 in 100. It would be hardly worth while, from a traffic point of view, to occupy the line with a smaller train than this, at all events if the line was working anywhere near its full capacity, and it would be better to let the passenger locomotive lie over until required to work a return trip with a passenger train.

A small boiler provides steam to heat the passenger coaches and, so far as is known, it is the first electric boiler used for this purpose in which the heating elements are designed for d.c. at 1,500 volts. To provide the boiler with electricity at a lower pressure would have required a motor generator of 300-kW capacity. The boiler is of the fire-tube type, each tube containing a heating element, consisting of a tube of quartz in the interior of which there is a spiral of high-resistance wire. The boiler contains in all 144 elements, and switchgear is provided, so that the number of elements in circuit can be varied as required.

Three types of locomotives may be mentioned: (*a*) geared with twin motors and quills (American and North-Eastern Railways); (*b*) gearless, with the motor armatures built on the driving axles (American); (*c*) gearless, with transmission by connecting rods (American, Prussian, French, Italian, Swiss, and other railways). To compare the performance curves the author has combined in one diagram, fig. 2, the curves of tractive effort against speed for the maximum condition of output for the locomotives described in his paper, and the comparison shows that the engines differ considerably in their capabilities in respect of both the load to be hauled and the speed at which the trains will travel.

A comparison of the curves shows that the North-Eastern Railway locomotive is well adapted to deal with the loads for which it is intended, and at the speeds at which it is desired to run, without being heavier or more powerful than is necessary for this duty.

While it is clear, therefore, that all these locomotives are not equally well suited to meet the requirements of express passenger traffic on the British railways, it does not follow that a suitable locomotive cannot be designed embodying any one of the systems of drive peculiar to the three general types mentioned above.

So far as the system of driving is concerned, any one of the three general schemes referred to above can be selected. In the author's opinion, however, the choice at present lies between the first two types, namely, the quill-drive and the gearless locomotive, and further experience is necessary before any decisive opinion can be expressed as to which of these two types is to be preferred.

The question as to the most satisfactory mechanical arrangement of an express passenger locomotive for the British railways must be considered with regard to the possibility of oscillations or nosing of the locomotive when running at high speeds. Experience in the United States, we are assured, has proved that an electric locomotive cannot be expected to travel satisfactorily at such speeds as we are considering, say, from 70 to 75 miles per hour, if the wheel arrangement is symmetrical. For example, a 4—6—2 locomotive might, perhaps, be satisfactory, whereas a 4—6—4 locomotive would be unsatisfactory. This is an important point if one bears in mind that one of the advantages of electric working is that there is no necessity for turning the locomotive at the end of each journey. This is only possible if the locomotive can run equally well in both directions. For such speeds as we are considering it is desirable that in whichever direction the locomotive runs there should be a bogie leading. Engineers in the United States recommend one or other of the various designs which are based on the articulation of two locomotives back to back, with the idea that while the locomotive, considered as a whole, is symmetrical, each part of the locomotive is unsymmetrical, and that therefore each part will run satisfactorily without setting up violent oscillations of the locomotive as a whole.

It is difficult to find any satisfactory explanation of the difficulties which have been experienced in the United States in this direction, especially in view of the fact that there are on the British and Continental railways already a fair number of symmetrical locomotives which are capable of running at high speeds. There must be some cause which gives rise to violent oscillations on symmetrical electric locomotives when running in the United States which are absent when symmetrical steam locomotives are run in Europe. It appears to the author that the oscillations can only arise from the fact that there is a periodic disturbance tending to set up horizontal oscillations, the frequency of this disturbance being the same as the natural frequency of the locomotive in oscillating in a horizontal plane. As soon as these two frequencies coincide the oscillations tend to increase until they become dangerous. This natural frequency of the locomotive, however, while it may possibly be slightly changed by an unsymmetrical distribution of the masses on the locomotive superstructure, cannot certainly be eliminated, so that any such distribution might possibly affect the speed at which these violent oscillations occur without in any way eliminating the tendency to oscillate.

There is no doubt a good deal yet to be learned about the behaviour of electric locomotives of a symmetrical arrangement when running at high speeds, but the author suggests that one cause of the trouble experienced in the United States and from which the European railways seem to be free, is that on practically all the railways in the United States the rail joints are staggered, whereas on the British and French railways the rail-joints are opposite to each other. It is hoped that after extended trials of the 4—6—4 locomotive on the North-Eastern Railway the author will be in a position to express a more definite opinion.

REVIEWS.

A Course in Electrical Engineering. Vol. II. *Alternating Currents.* By Chester L. Dawes, S.B., M.A.I.E.E., Assistant Professor of Electrical Engineering in the Harvard Engineering School. Pp. xiv+526; figs. 406. London and New York: The McGraw-Hill Book Co. Price 21s. net.

The Principles of Alternating Currents. By R. R. Lawrence, M.A.I.E.E., Associate Professor of Electrical Engineering in the Massachusetts Institute of Technology. Pp. xiv+432; figs. 121. London and New York: The McGraw-Hill Book Co. Price 20s. net.

The first of these books, one of several on very similar lines which have emanated from America since the war period, is concerned, for the most part, with a study of the laws governing the flow of alternating currents in circuits and the application of these laws to electrical machines.

In his preface the author describes the work as being of an elementary character, but this term hardly does justice to the contents of the book, which, while not attempting to deal completely with the theory of machines, certainly goes beyond what is usually considered to be an elementary account.

We may say at once that the book is distinctly above the average as regards the quality of the explanations given of alternating current phenomena, and, for a first edition, is remarkably free from errors of any kind.

Following a good preliminary statement as to the sphere and advantages of alternating currents, the earlier chapters, dealing with the flow of currents, are well written, and the treatment of the vector addition of pressures or currents is particularly good, a system of lettering being used (the double subscript system) with a view to preventing the possibility of vectors being accidentally reversed when additions are being made. The application of this method is likely to be particularly useful when dealing with the interconnection of polyphase systems, oftentimes a serious source of trouble with students.

Alternators, transformers, and motors (of the induction, synchronous, and commutator types) are considered in turn, particular attention being paid to both the time and space relations of the quantities concerned. In the chapter on converting plant an account is given of several forms of rectifiers, but chief attention is directed to the rotary converter, which is described in an efficient manner. There is no account of the motor converter, a machine which surely merits inclusion.

Chapter XII. is concerned with a concise description of the appliances used in connection with the transmission line, and would be improved if some account of protective relays for use with oil break switches was included; the oxide type of lightning arrester is also worthy of mention. The final chapter deals with illumination and photometry. It seems to have no direct relationship to the other matter in the book, and would probably be better omitted in a book primarily concerned with alternating current machines.

Minor criticisms may perhaps be made against the use of the term "ohm" in connection with the unit of reactance (it would be better to employ the more usual term "apparent ohm") and also against the tendency, which seems very usual in books of American origin, to refer to a lamp having a tungsten filament as a "Mazda" lamp.

The printers and publishers are to be congratulated on the general get-up of the book, which can be recommended to students as one from which sound and accurate ideas will be obtained.

The matter in the second of the books mentioned above is practically solely concerned with the problems arising from the flow of alternating currents in circuits, references to machines being of an incidental nature.

The mode of treatment adopted is mathematical, considerable use being made of the method of complex quantities, though other methods are used when desirable, and it is remarkable for the completeness of detail with which the majority of the problems are examined. A fair knowledge of the calculus is necessary in order that certain parts of the work may be followed in a satisfactory manner, but no preliminary knowledge of complex quantities is assumed, the use of these being described in the first chapter.

The more orthodox contents of the book include studies of the effects of capacity and inductance in circuits, power in single and polyphase circuits, and transmission line phenomena. In addition there are a number of chapters dealing with matters of exceptional interest, but which are less commonly considered in text books. Under this category come the effects of harmonics in single and polyphase circuits (a subject whose treatment may be particularly well commended), the application of Kirchoff's laws to alternating current circuits and the transposition of power lines and telephone lines with a view to the prevention of induction effects in the latter.

When each matter is discussed in such detail it is not easy to criticise, but, in future additions, we suggest that the skin effect in conductors might be treated at greater length, and, when comparing the amounts of copper used in different systems of transmission, attention should be paid to the three-phase four-wire system as compared with the three-phase three-wire system using an equal pressure on the lamps.

The work is perhaps likely to prove too mathematical for many practical engineers, but students taking day courses will find in it abundant material of interest and importance whether their interests lie in the direction of light or heavy engineering. It should also be of great use to teachers, and is very suitable for inclusion in the libraries of technical colleges.

The All-Electric Age. By Adam Gowans White, B.Sc. Pp. xiii+242, 50 illustrations. London: Constable & Co., Ltd. Price 7s. 6d. net.

"The All-Electric Age" is not a dry technical work, but a well-written and most interesting description of the changes which electricity has produced and will produce in social, industrial and domestic conditions. As its author claims, "electricity is dealt with as a factor in civilisation, not as a science or branch of engineering." The period covered is some sixty years, that is, from the days of Michael Faraday's great scientific discoveries down to the present time, when the wonderful developments have created an industry which, in Great Britain alone, represents a capital of close on £500,000,000 and "profoundly affects the lives of millions of people" in all parts of the world. A vision is also given of what we are to expect in the future.

In chapter I, The Birth of Electricity, commenting on the progress already made, the author says that "the wonders of the last forty years are only a prelude to the wonders to come"; that every discovery and improvement has opened up new possibilities of service to industry, security, or health, and no one anticipates the day when the progress will be arrested. The probable reason for the belief in the infinite possibilities of electricity is sugested in the following words:—

"When we analyse 'matter' and 'energy' we find electricity. The atom—once regarded as an indivisable grain of solid substance—is now conceived as a complex system of revolving electrons or infinitesimal charges of electricity. In radium we have an example of the system breaking up and throwing off its charges of electricity in the process. The special properties of the different elements are regarded as the outcome of various numbers and arrangements of electrons. Thus the ultimate 'stuff' of the universe is nothing else than electricity; and in the last resource all science is the study of electricity."

Chapter II treats of electricity itself, and of how it is made and how applied. After giving an amusing apology for declining to describe what electricity *is*, and speaking of its mysterious nature, its invisibility and intangibility, the author truly points out that the electrical engineer knows well what electricity can *do*. He can control it with certainty and measure its quantity, its pressure, and its energy with the greatest possible degree of accuracy, and even makes use of electrical instruments to measure any effect with precision. "Thus the thing which in itself seems most elusive to our senses is the most reliable guide to what is going on among the solids, liquids, and gases that we can see or weigh or analyse." This interesting chapter pleasantly imparts much general knowledge of electricity and electrical machines to the reader.

The scope and completeness of "The All-Electric Age" is shown by the titles of Chapters III to XIII: III—Pioneer Days in Electric Light and Traction; IV—Electric Traction on Roads; V—Industrial Uses of Electricity; VI—The Growth of Central Power Stations; VII—The Coming of the Super-Station; VIII—Modern Electric Lighting; IX—Electric Heating; X—Electric Cooking; XI—The Labour-Saving Home; XII—Electricity and Health; XIII—Electricity in Communication. In these chapters is given in language which all can understand, the history of electricity and a good idea of many electrical instruments and machines, from the simple battery invented by Volta to the great creations now to be found in the modern super-station, forming an absorbing story of the wonderful growth of electricity, of what it is doing, of how it is doing it, and what it is likely to do in the future in brightening the home, in lessening labour, in increasing industrial output, in facilitating transport, in bettering intercourse, and in promoting the health of mankind.

In the concluding chapter (XIV), which deals with the future, it is said that among the visions of the various unsatisfying mechanical Utopias which men have conjured up electricity plays a large part in reducing work to the pressing of a button to summon aid as versatile and efficient as the genii of the Arabian Nights. But it is pointed out that the all-electric age, or the Utopia of the electrical engineer, "is a different affair," for, "it contains nothing extravagant, nothing that demands a new kind of human being in order to be enjoyable or even tolerable. Neither is it a kind of Futurist sketch; it is a glimpse of the actual—that is, advanced examples of electrical application." Notwithstanding, the picture painted of country life—the new "back to the land"-the home, the factory, and the city of the future, which electricity could, and probably will, bring about, appears as a page from a pleasant romance.

"The All-Electric Age" is well printed on good paper.

The text is illustrated by some fifty half-tone and line blocks, and there is a general index at the end of the book.

In conclusion, though the work is neither a text book nor a work of fiction, it is as instructive as the former and as interesting as the latter, and should have a large sale.—C.H.C.

Electricity in the Service of Man. Vol. II, Section 2. Technology of Electricity. By R. Mullineux Walmsley, D.Sc. Pp. ix+2,214; illustrated. London: Cassell & Co., Ltd. Price 15s. net.

The present volume deals with Electric Traction, Electric Lighting, Electrochemistry, Electrothermics, and Measuring Instruments. The work follows the general lines of the earlier edition, but it has been completely modernised and brought up to date. It is remarkable for the clear and simple language of the text and for the very large number of excellent illustrations which are rendered more valuable by the addition of dimensions to many of the drawings. This is a feature which is not as common as it might be in electrical text-books, probably because it is so much easier to insert a block from a manufacturer's catalogue.

This volume is mainly concerned with the descriptions of the actual apparatus used in the branches of electrical engineering outlined above, the fundamental theory underlying the design being dealt with elsewhere. Most of the examples are well chosen, and the amount of space devoted to each is in proportion to its novelty or importance. The author who is evidently a believer in the future of battery-driven electric vehicles, describes several modern examples and gives curves showing the annual costs for running and maintenance. A dimensioned drawing is included in this section showing the method of driving the front wheels by individual motors on a well-known type of electric lorry. A battery-driven locomotive for shunting work is stated to be fitted with a battery of 108 ampere-hours capacity. This would appear to be an error, since the current taken by the motors may be as much as 150 amperes.

The chapter on domestic electric lighting is not up to the standard of the rest of the book.

A considerable amount of space is devoted to descriptions and illustrations of well-known pieces of apparatus, such as switches and ceiling roses, with which even a lay reader might be expected to be familiar, whilst the different systems of wiring are not described at all.

A very interesting account is given of a large mercury-arc rectifier of the iron-clad type for traction work and the methods of paralleling and compounding these rectifiers are dealt with in some detail. There is also a description of an automatic sub-station and hydro-electric generating station.

The lamp in which an arc is formed between tungsten electrodes in a partial vacuum is dealt with fully, as is also the Sperry flame arc for projectors, which embodies many interesting devices, and appears to be a distinct advance on the earlier forms of searchlight.

The chapter on electro-plating contains much practical information on modern processes. In describing the Beardmore process for building up the water jackets of aero-engine cylinders by electrolytic deposition, the author states that the jacket is deposited "after the cylinder has been secured to the crank case and sweated on."

There is evidently an omission here; the reference is probably to the flange which secures the completed cylinder to the crank-case.

Several kinds of electric furnaces are described and also different methods of electric welding.

The book closes with a chapter on measuring instruments and meters.

The work, as a whole, is undoubtedly one of the best of its kind. It is written in such a way that it is exceedingly interesting to read, whilst at the same time containing a great amount of practical information. It is profusely illustrated and will prove valuable to students and to the large number of engineers who are compelled to specialise in a particular subject, but who like to know what is being done in the other branches of their profession.

MAKING HAY THE ELECTRIC WAY.

The Sunshineless Method.

So little headway has been made with the harvest that the country presents a very striking contrast with its aspect at this date last year. Rain and cold during the ripening period invariably affect the quality of all produce. While farmers are dubious about the quality of their cereals they have no illusions about their hay. They have cut a greater bulk because of the July rain, but much of it is still uncarted, and in consequence its feeding value will be below what it should be, so that welcome as the rain is for the other crops, it is seriously interfering with haymaking. Apart from the additional cost of labour involved in turning and redrying the grass, which has been caught in showers after being partially dried, the value of the resulting hay is very much reduced as a cattle food. Although no great harm is done if the swathes of grass, as cut by the mowing machine, are left untouched until the rain has passed off, every drop of rain falling on the partly-dried grass after it has been once turned and shaken out of the original swathe washes away a proportion of the more easily dissolved constituents, which are of the greatest value from the nutritive point of view.

As the aim of the farmer is, or should be, to secure the greatest feeding value from his crops, it is easy to understand that the time-honoured method of making hay in the usually showery haymaking season is far from efficient. The more enlightened agriculturists have long recognised this fact, but it is only recently that any steps have been taken to find remedies therefor. On the Continent experiments have been tried (but with little success) to make hay by artificially reproducing the dry action of the wind on green cut grass. In a recent paper* read before the I.E.E. by Mr. R. Borlase Matthews, M.I.E.E., reference was made to some successful small-scale experiments which he had carried out in Scotland with improved methods of producing hay in rainy seasons. Following these experiments he this year made hay on a commercial scale by stacking 50 loads of grass off the field immediately it was cut; the yield was very heavy, and fully 25 tons of excellent hay is the result.

The grass was stacked as quickly as it could be carted to the rick, which was built in the usual manner, an air chamber being left in the centre of the stack and connected to the outlet of an electrically-driven "Sirocco" fan, and the natural heating due to the action of the fermentation bacteria was thus kept within safe limits by intermittent blowing, thermometers being used to register the temperatures.

Thermometer pockets were placed in definite positions in the rick as it was built, the positions being chosen as being theoretically the hottest places, and independent readings by hay thermometers stuck in at various other parts confirmed the accuracy of the results. Owing to causes which have now been corrected much more power was consumed than will be necessary in future. A second rick of similar size has since been cured, the total energy used for blowing being only 34 units of electricity. At 1d. per unit this amounts to 2s. 10d. for the stack, or 1.3 units per ton of cured hay. A third large rick—a continuation of the second—is now in progress.

It is worthy of note, however, that notwithstanding this fact, the hay made with the aid of the electric blower has cost much less than if it had been made in the usual way. At the same time the quality is superior and its feeding value much greater. At the time the grass was cut the weather was fine, but rain fell later and every day since; in the 14 days during which the hay rick was under hourly observation over 2¼ in. of rain fell. Two loads of grass which were made into hay on the field were only carted after 23 days, and it was then not properly cured in spite of repeated turnings and redrying. As is to be expected, the food value of this field hay is consequently much lower than that of the rick hay, and it costs more to make. The stack hay was completed in nine days (in less than half the time taken for the field hay cut at the same time).

So successful has been the result that a still further improved system of air ducts has been put down, and Mr. Matthews proposes to make the grass of an 80-acre meadow on his farm into hay this year, using his improved system. A noteworthy feature is that the ricks are of the usual rectangular type, and may be made as large as desired (it is well known to farmers that the larger the rick the better the hay). In exceptionally good weather hay can be made on the field, can be stacked over the ducts, which are then available as safety air passages in case of any overheating (which is only too common in the ordinary hay stacks) should occur. There is no doubt that this system has provided the farmer with a real means of circumventing the weather and the cost of the equipment can be paid off by the savings it makes in one normal season.

The cost of the electric power for drying the hay on this first large-scale experiment, on a rick, which when finished measured 20 ft. wide by a similar height, and of greater length, was 30s., very considerably less than the cost of turning the hay would have been. This represents the cost under the worst conditions, and even then it is under 2s. 3d. per ton for power. The capital cost of the electric fan was under £50—and it will have, judged by previous experience, a life of over 20 years.

A greater weight per acre of grass has, of course, to be carried than of hay, but practical experience shows that, owing to the greater ease with which it can be loaded and packed on the wagons, the man-hours and wagon-hours are no greater than for hay dried in a field.

Arrangements are being made to electrically cure and dry the corn sheaves on Mr. Matthews's farm directly they are cut. Thus losses from stacking on the fields will be eliminated, and further, ploughing can be commenced directly the cutting of the crop is done.

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*"Electro-Farming, or the Applications of Electricity to Agriculture," Elec. Rev., April 7th, 1922.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,870. "Wireless systems and apparatus." J. Robinson. July 31st.
21,493. "Device for protection of electrical heating elements and containers therefor from damage by overheating." R. Hurry. August 8th.
21,495. "Thermionic devices." E. Y. Robinson. August 8th.
21,520. "Electric batteries." M. I. David and E. E. Dutt. August 8th.
21,525. "Electric pendulum bell indicator." H. L. Holley and A. F. Norris. August 8th.
21,526. "Train control by electric means." L. Abrahams, H. Ball, A. McInnes, and P. Sampson. August 8th.
21,527. "Wireless tuning inductance." P. A. Broadwood and H. W. Choate. August 8th.
21,528. "Sliders for tuning inductance coils." J. Clegg. August 8th.
21,532. "Electric controllers." R. Amberton. August 8th.
21,536. "Electric batteries." G. N. Antonoff. August 8th.
21,555. "Control of and communication with trains." A. R. Angus. August 8th.
21,565. "Fibre-covered cores, and manufacture thereof." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 8th.
21,566. "Telephone systems." L. Polinkowsky and Western Electric Co., Ltd. August 8th.
21,588. "Safety device for electric precipitation apparatus." Lodge-Cottrell, Ltd., and L. Lodge. August 8th.
21,601. "Coil holders for wireless signalling systems." A. H. Curtis, Igranic Electric Co., Ltd., and A. H. Mackley. August 8th.
21,604. "Switch mechanism." H. A. H. Nijland. August 8th.
21,611. "Spark-plug testers." W. P. Moore. August 8th.
21,619. "Changeable tread rail for tramways." W. J. Saunders. August 9th.
21,620. "Electrical devices to prevent starting of internal-combustion engines." A. Buck. August 9th.
21,635. "Electric primary battery." M. I. David and E. E. Dutt. August 9th.
21,636. "Electric cells." M. I. David and E. E. Dutt. August 9th.
21,665. "Magneto-electric ignition machines." A. G. L. Neighbour. August 9th. (Australia, August 9th, 1921.)
21,673. "Electric advertising sign." A. M. Leyfield. August 9th.
21,683. "Submarine cable telegraph systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 9th.
21,691. "Wireless telegraphy." H. Abraham. August 9th. (France, August 9th, 1921.)
21,692. "Street lamp." E. G. Casey. August 9th.
21,703. "Automatic telephone-call recorders." J. A. L. Stokes. August 9th.
21,721. "Electrical joint boxes." C. J. Baker and E. R. Ingram. August 9th.
21,731. "Sparking plugs." A. Segal. August 9th.
21,732. "Sparking plugs." A. Segal. August 9th.
21,733. "Sparking plugs." J. H. Runbaken and W. Torrance. August 9th.
21,738. "Electrolysis of zinciferous materials." F. Hansgirg. August 9th. (Austria, September 30th, 1921.)
21,749. "Ceiling eyes, &c., for pendant electric lamps." C. Skaife. August 10th.
21,750. "Wall bracket electric lamps, comprising battery and bulb holder." Efandem Co., Ltd., and G. Green. August 10th.
21,751. "Roof electric lamps for interiors of motor vehicles, &c." Efandem Co., Ltd., and G. Green. August 10th.
21,752. "Electric torches." Efandem Co., Ltd., and G. Green. August 10th.
21,767. "Electric-current limiting device." Aktiebolaget Birka Regulator. August 10th. (Sweden, September 30th, 1920.)
21,768. "Electric switches." Aktiebolaget Birka Regulator. August 10th. (Sweden, September 30th, 1920.)
21,769. "Adaptor for telephone earpieces." H. W. Parker. August 10th.
21,788. "Radio signalling." M. Smith. August 10th.
21,789. "Electric terminals, bayonets, and sockets." A. Rothschild. August 10th.
21,794. "Telephone receivers." A. Orling. August 10th.
21,796. "Tramcars, &c." J. L. Burton and English Electric Co., Ltd. August 10th.
21,818. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. August 10th.
21,819. "Electric arc welding apparatus." British Thomson-Houston Co., Ltd., and A. P. Young. August 10th. (United States, September 23rd, 1921.)
21,826. "Arc gap terminals." Balt Manufacturing Co. August 10th. (United States, April 17th.)
21,827. "Incandescent filament electric lamp bulbs and lamp holders therefor." H. Workman. August 10th.
21,830. "Means for obtaining graphic record of electric currents." Marconi's Wireless Telegraph Co., Ltd. August 10th. (United States, December 6th, 1921.)
21,831. "Adjustable electrical apparatus." N. S. Magnus. August 10th.
21,836. "Multi-layer electrical coils for wireless telegraphy, &c." H. L. Thomas. August 10th.
21,837. "Electric storage batteries." Chloride Electrical Storage Co., Ltd. (B. Ford). August 10th.
21,841. "Charging device for miners' electric lamps." Concordia Elektrizitäts Akt. Ges. August 10th. (Germany, September 29th, 1921.)
21,845. "Support for electric resistance or reactance coils." W. W. Peck. August 11th.
21,875. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 11th. (United States, October 12th, 1921.)
21,885. "Rectifying devices." A. R. Angus. August 11th.
21,905. "Devices for testing ignition in internal-combustion engines." R. T. Monk. August 11th.
21,910. "Electric motor control systems." R. H. Barbour and J. R. Walton. August 11th.
21,919. "Automatic emergency lighting systems." M. Arbus. August 11th.
21,927. "Illuminating plant for motor cycles, &c." K. Knapp and F. Neumeyer Akt. Ges. August 11th. (Germany, August 15th, 1921.)
21,929. "Electrical couplings." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. August 11th.
21,933. "Terminal connections for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). August 11th.
21,934. "Electric starting gate for racecourses, &c." J. Bageart. August 11th.
21,941. "Microphones." N. W. McLachlan. August 11th.
21,942. "Burglar alarms." G. B. Carpenter. August 11th.
21,948. "Combining electric cooking with heating." C. B. Gresham and H. W. Sullivan. August 12th.
21,959. "Automatic telephone systems." W. H. Grinsted and Siemens Bros. & Co., Ltd. August 12th.
21,960. "Means for sealing tappings on wireless tuning coils, &c." H. W. Parker. August 12th.
21,967. "Horns for loud-speaker telephones." J. J. Hummerston. August 12th.
21,990. "Apparatus for use in telegraph, &c., circuits." H. S. Pocock. August 12th.
21,996. "Apparatus for making electrical connections with plunger terminals." F. H. Smith. August 12th.
21,999. "Systems for measuring capacity of electrical circuits." D. Nunn and Western Electric Co., Ltd. August 12th.
22,000. "Electrical transformers." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 12th.
22,003. "Rotary converters." English Electric Co., Ltd. August 12th.
22,007. "Control systems for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. August 12th.
22,014. "Electric relays." J. L. L. Verney. August 12th. (France, August 19th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

3,303. "Elevators." H. Simon, Ltd., and C. P. Kininmonth. January 27th, 1921. (183,495.)
5,849. "Electric control systems." British Thomson-Houston Co., Ltd. (General Electric Co.). February 21st, 1921. (183,503.)
8,798. "Automatic regulation of a petrol or paraffin internal-combustion engine driving an electric generator subject to sudden load changes." H. Ogden and British Arc Welding Co., Ltd. March 22nd, 1921. (183,516.)
8,872. "Sparking plugs." T. Morrin. March 22nd, 1921. (183,523.)
8,883. "Renewal of the filaments in metal-filament electric lamps." A. H. S. Colebrook and W. A. Williams. March 23rd. 1921. (183,525.)
9,172. "Sound-emitting and receiving devices." Submarine Signal Co. (March 26th, 1920.) (160,798.)
9,959. "Ships' telegraphs and like indicating apparatus." W. Clark (C. P. Clark). September 19th, 1921. (183,528.)
10,883. "Control devices for dynamo-electric generators." R. Bosch Akt. Ges. May 3rd, 1920. (168,031.)
10,990. "Rheostats." S. T. Quilliam (Electric Railway Improvement Co.). April 15th, 1921. (183,533.)
11,679. "Electric arc lamps." S. B. Ausas. April 22nd, 1921. (183,557.)
11,874. "Head lamps for motor vehicles." Pallas-Zenith Ges. and H. Breitbart. April 25th, 1921. (183,570.)
12,005. "Means for the mounting and driving of magneto-electric machines on motor-propelled vehicles." R. B. North and A. M. Allen. April 26th, 1921. (183,580.)
12,052. "Electrical connectors." E. W. Pattison (Dictograph Products Corporation). April 27th. 1921. (183,584.)
12,119. "Lamp-shade supports." A. J. H. Haddan (Greist Manufacturing Co.). April 27th, 1921. (183,588.)
12,120. "Portable lamps." A. J. H. Haddan (Greist Manufacturing Co.). April 27th, 1921. (183,589.)
12,145. "Rheostats." N. E. North and Metropolitan-Vickers Electrical Co., Ltd. April 27th, 1921. (183,592.)
12,271. "Electric transformers." Metallurgique Electrique. October 29th, 1920. (170,821.)
12,334. "Electrically-propelled road vehicles." R. Freeman and Railless, Ltd. April 29th, 1921. (183,596.)
12,993. "Electrical operation of railway and like switch-points from the vehicles." M. Loughridge. May 6th, 1921. (183,611.)
12,994. "Alternating-current motors." Dewhurst & Partner, Ltd., and M. Dewhurst. May 6th, 1921. (183,612.)
13,064. "Lubricating means for loose pulleys, trolley wheels, guide rollers, and like free-running members." A. E. Nixon. May 7th, 1921. (183,613.)
13,225. "Electric locomotives." E. C. R. Marks (Soc. Anon. Constructions Electriques de Belgique). May 10th, 1921. (183,616.)
13,661. "Dry cell and method of manufacturing the same." Burgess Battery Co. May 15th, 1920. (163,317.)
13,662. "Dry cell and method of manufacturing the same." Burgess Battery Co. May 15th, 1920. (163,318.)
13,910. "Electric heating devices or elements." Phi-Kappa Syndicate, Ltd., and J. J. J. M. Kiuijtmans. May 18th, 1921. (183,631.)
13,936. "Dynamo-electric generators." Watts, Williams & Co., Ltd., and J. R. Middleton. May 18th, 1921. (183,632.)
14,289. "Combined switches and plugs for electrical purposes." J. B. Tucker. May 23rd, 1921. (183,637.)
14,954. "Electric synchronous machines." Compagnie Générale Electrique. October 27th, 1920. (170,824.)
14,977. "Electric synchronous machines." Compagnie Générale Electrique. March 23rd, 1921. (Addition to 170,824.) (177,490.)
16,800. "Anodes for mercury vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. June 18th, 1920. (165,093.)
17,246. "Pressure-responsive electric-circuit controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). June 23rd, 1921. (183,678.)
17,811. "Conductors for making electrical connection with mercury." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th, 1921. (183,683.)
17,964. "Terminals for rail bonds and the like." F. C. Brittain and Westinghouse Brake & Saxby Signal Co., Ltd. July 1st, 1921. (183,684.)
18,267. "Sparking plugs for internal-combustion engines." W. Pickard. July 6th, 1921. (183,688.)
18,296. "Hunting arrangements in telephone systems." Siemens Bros. and Co., Ltd., E. A. Petithory, and J. E. Collyer. July 6th, 1921. (183,689.)
18,297. "Clamps for electrical junction boxes for bonding metallic-sheathed wires and the like." G. S. Boothroyd, S. E. R. Beecroft, and Callender's Cable and Construction Co., Ltd. July 6th, 1921. (183,690.)
18,541. "Telephones operated by heat." L. B. Miller. July 8th, 1921. (Cognate applications 20,266/21 and 27,379/21.) (183,692.)
18,825. "Electric arc-gap terminals." J. Y. Johnsons (Balt Manufacturing Co.). July 12th, 1921. (183,699.)
18,952. "Contact breakers for fly-wheel magnetos." Villiers Engineering Co., Ltd., F. Poutney, and J. Bradley. July 13th, 1921. (183,702.)
18,975. "Means for indicating the state of adjustment or output of dynamo-electric machines." J. Stone & Co., Ltd., and A. H. Darker. July 13th, 1921. (183,703.)
21,006. "Anchor for the stays of telegraph and like poles." T. S. Entwistle. August 8th, 1921. (183,716.)
25,544. "Device for the automatic operation of an electric circuit-breaker controlled by the pressure of a movable medium." Maschinenfabrik Oerlikon. October 9th, 1920. (169,970.)
27,622. "Trolley collectors for electrically-driven tramcars or road motor vehicles." P. T. J. Estler, E. P. B. Estler, and H. P. C. Estler. October 18th, 1921. (183 756.)
28,411. "Combination electric switch and fuse." A. H. Short. October 26th, 1921. (Addition to 8,456/14, as modified by 6,196/15.) (183,762.)
29,306. "Signalling systems employing light-emitting devices." McKenzie Holland and Westinghouse Power Signal Co., Ltd. March 2nd, 1921. (176,313.)
30,625. "Method and device for separating suspended particles from electrically-insulating fluids, especially gases." Lodge Fume Co., Ltd. (E. Möller). November 16th, 1921. (183,768.)
30,628. "Multiple fuse." J. Szykier. November 24th, 1920. (171,999.)
30,752. "High-voltage slot windings of electrical machines, and the process for the manufacture of same." Akt. Ges. Brown, Boveri et Cie. December 16th, 1920. (172,339.)
34,843. "Arrangement for minimising or suppressing sparking on the interruption of powerful alternating currents." H. Abraham. December 28th, 1920. (173,514.)

1922.

17,788. "Electric arc welding applicable for welding studs, tubes, and the like to or into metal plates, bodies, and the like." L. J. Steele, H. Martin, and A. E. McCarthy. January 19th, 1921. (Divided application on 183,161.) (183,787.)